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Compressed Air Magazine

UNIQUE SPILLWAY AT VERMONT DAM

Overflow of Harriman Power Reservoir Cascades 180 Feet Down Glory Hole

VOLUME 58 • NUMBER 7

NEW YORK • LONDON

COPPUS "BLUE RIBBON" VENTILATORS

Used in wide variety of applications throughout industry

Improve workers' safety . . . health . . . comfort . . . efficiency

VANO DESIGN "A" VENTILATOR is used here during repairs to a chemical still. This type ventilator is used to ventilate tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments, fuselages and other confined places. Uses 8" diameter flexible canvas tubing ("Ventube").

VANO DESIGN "B" VENTILATOR here discharges welding fumes from double-bottom compartment in naval vessel under construction. Large volume of air handled quickly expels fumes and results in good ventilation. Vano Design "B" can pass through opening only 14" in diameter. Uses 8" diameter flexible canvas tubing ("Ventube").

VANO DESIGN "C" VENTILATOR here withdraws fumes from a reactor kettle. This ventilator can be furnished with 8" suction inlet for 8" non-collapsible suction tubing — or multiple inlet nozzles for 5", 4", and 3" suction hose. The discharge may be connected to 8" "Ventube." Capacities furnished on request.

NO. 2 AEROPLANE HEAT KILLER here directs cool, fresh air on worker in drop forge plant. Heat killers restore workers' efficiency by providing extra ventilation in the hot months, or on any job where workers are continually or periodically required to work in excessive heat. Available in two types, three sizes in each.

VENTAIR DESIGN TE-4 VENTILATOR Gasoline Engine Driven, here delivers air into underground manhole. These ventilators provide fresh air to men in confined places, promoting safety, comfort, and increasing efficiency. Ideal where no electric current is available. Delivers 1700 CFM of fresh air. Uses 8" diameter flexible canvas tubing ("Ventube").

PORTAIR NO. 4 BLOWER EXHAUSTER exhausts fumes resulting from soldering, welding, tank coating, is also used in ventilating small tanks. It is designed to permit attachment of 4" flexible metal hose. Capacity: 425 CFM free air.

ATTACH THIS COUPON TO YOUR COMPANY LETTERHEAD

COPPUS ENGINEERING CORPORATION, 207 PARK AVENUE, WORCESTER 2, MASS. Sales offices in Thomas' Register. Other "Blue Ribbon" Products in Chemical Engineering Catalog, Refinery Catalog, Best's Safety Directory and Mining Catalogs.

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- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens
- ☐ on steam-heated rubber processes
- ☐ on boiler repair jobs

COOLING:

- ☐ motors, generators, switchboards
- ☐ wires and sheets
- ☐ general man cooling
- ☐ around cracking stills
- ☐ exhausting welding fumes
- ☐ stirring up stagnant air wherever men are working or material is drying
- ☐ drying of walls, sheets, etc., after treated with coating material

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Write here any special ventilating problem you may have { _____ _____

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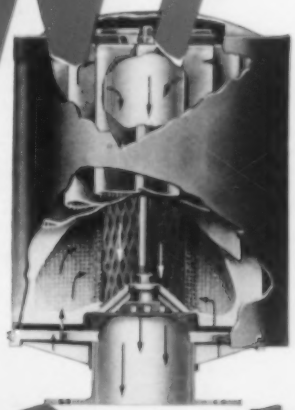

MODEL D
Intake Filter

STAYNEW INTAKE FILTERS

WHEN BUYING INTAKE FILTERS, you look first for efficiency. And, in Staynew Intake Filters, your dollars buy the MOST EFFICIENT INTAKE FILTER MADE!

They're *dry* . . . absolutely no oil carry over and no oil blow out on free air unloading equipment. They provide *maximum filtering area* in the smallest possible space. And they are *rugged!* Even under the most severe conditions Staynew Intake Filters perform a year or more *without attention.*

Get all the facts, and you'll buy Staynew Dry Type Intake Filters for the life of your engines.

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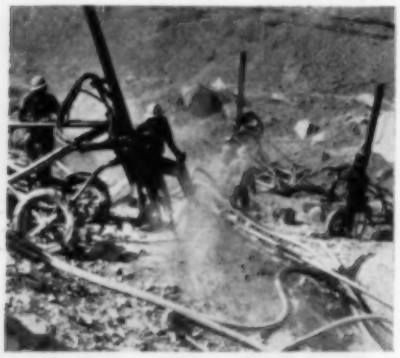
ALL TYPES OF FILTERS
FOR EVERY INDUSTRIAL NEED

Looking upstream, this view shows in the background the trestle used to place concrete for the main dam. A 162,000-kw power plant is to be located in the left foreground, about 105 ft below the normal surface of the American River.

Sketch shows location of main dam below the junction of the north and south forks of the river, about 20 miles northeast of Sacramento. The saddle dikes which plug low spots between hills around the reservoir bring the length of the dam to 26,730 ft. Shaded portion indicates future reservoir.



Drilling deep blast holes with wagon drills is tricky because the granite is quite hard in some spots and decomposed in others. Large quantities of Bethlehem Hollow Drill Steel are used.

Folsom Dam to supply power and irrigation, tame floods in Sacramento Valley

Usually the American River flows ever so gently down the slopes from the crest of the Sierra range. But if the rainy season happens to strike at a time when melting snow is swelling the mountain streams, the river changes character abruptly, like Dr. Jekyll, and goes on a rampage, roaring through the foothills and pouring floodwaters over the rich farmlands that lie downstream.

Now well under way is a $65 million project, near Folsom, Calif., to tame the American River and at the same time store its valuable water for both irrigation and hydroelectric power.

In addition to the 1,400-ft-long concrete section of the main dam, the Folsom project includes two other dams with wings and eight saddle dikes of rolled earth fill, which bring the overall length to 26,730 ft. The design of the concrete structure calls for not only the building of a dam, but also for a dam site. To anchor the 340-ft-high section, a huge excavation has had to be gouged out of granite far below the normal bed of the river at the spillway area.

Several million cu yd of rock and earth are involved in the $29,444,000 contract which Merritt-Chapman & Scott Corp. and the Savin Construction Corp. hold with the Corps of Engineers, Sacramento District. Large quantities of Bethlehem Hollow Drill Steel, with carbide-tipped bits, are helping to speed the rock excavations.

Before the project is completed in early 1955 some 13 million cu yd of fill and more than 1 million cu yd of concrete will have been placed.

BETHLEHEM STEEL CO., BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

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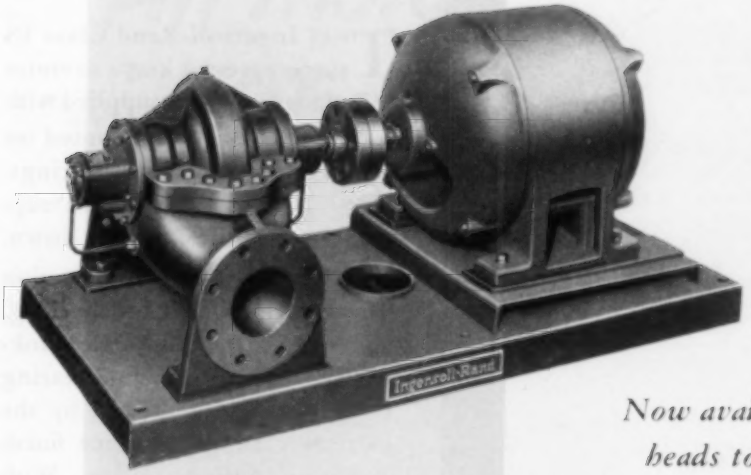
BETHLEHEM HOLLOW DRILL STEEL

ELIMINATE MAINTENANCE PROBLEMS

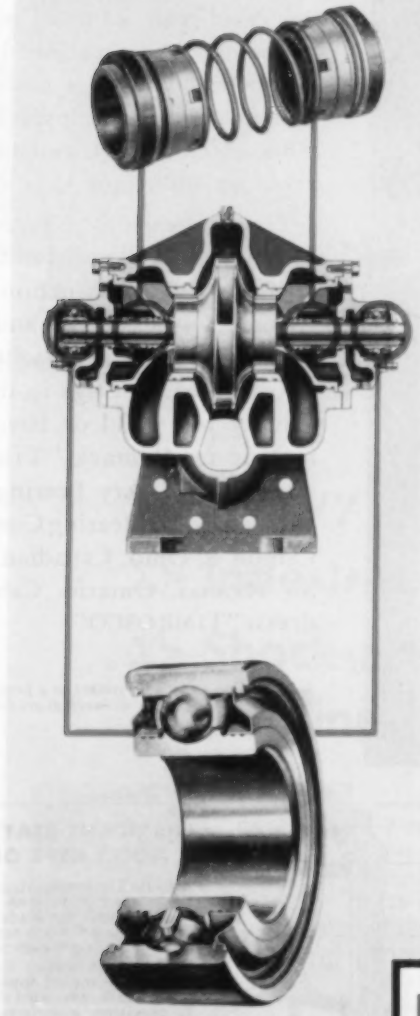
with

Ingersoll-Rand

DMV PUMPS



Now available for general hydraulic service heads to 300 ft.—capacities to 1900 gpm



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There are no packed stuffing boxes in the new DMV pumps. No periodic adjustment—no repacking—no annoying leaks. Double Mechanical Shaft Seals are *standard equipment* with water pumps. These performance-proved mechanical seals are self-adjusting—require no attention for the entire service life of their sealing faces. Replacement, when needed, is greatly simplified by easily accessible seal-box extensions. Double seals give better pump performance under suction lift, too—and last longer on gritty-liquid service.

NO BEARING LUBRICATION

Greasing or oiling of pump bearings is a thing of the past. The DMV uses modern, cartridge-type ball bearings with the lubricant *permanently sealed in.* Sealed bearings of this same type have operated successfully and without attention for periods of more than 11 years in tough service!

Now you can put an end to the care and nursing of outdated pumps. The DMV line gives you a pump that can be installed anywhere with complete confidence. Maintenance requirements are practically zero. And the simple, accessible design saves on spare parts inventory—cuts costly down-time.

Call your nearest I-R branch office for the full story. Or write for Bulletin 7248.

888-10

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Cameron Pump Division
11 Broadway, New York 4, N. Y.

COMPRESSORS • GAS & DIESEL ENGINES • AIR & ELECTRIC TOOLS • ROCK DRILLS • VACUUM EQUIPMENT • TURBO-BLOWERS

Keeps up plant's air supply with TIMKEN® bearings to hold down wear

How **INGERSOLL-RAND** mounts the crankshaft of its Class ES air compressor on Timken tapered roller bearings.

THIS Ingersoll-Rand Class ES air compressor keeps an entire manufacturing plant supplied with air. Its crankshaft is mounted on Timken® tapered roller bearings. Why? To insure a steady air supply, keep compressor wear down.

How? By eliminating friction between crankshaft and bearing, Timken bearings eliminate crankshaft wear. Friction in the bearing is practically eliminated by the extremely smooth surface finish and true rolling motion. With the crankshaft held in positive alignment, wear on adjacent parts is reduced. Housings and shafts are held concentric, closures made more effective. Dirt, moisture are kept out—lubricant kept in.

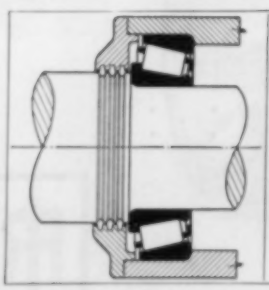
Timken bearings' tapered construction takes all radial and thrust loads in *any* combination. Line contact between rollers and races adds load-carrying capacity. Specify Timken bearings in the machinery you build or buy. Look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



LUBRICANT STAYS IN —DIRT KEPT OUT

Because Timken bearings hold shafts concentric with housings, closures are made more effective. Lubricant is retained, dirt and moisture kept out.

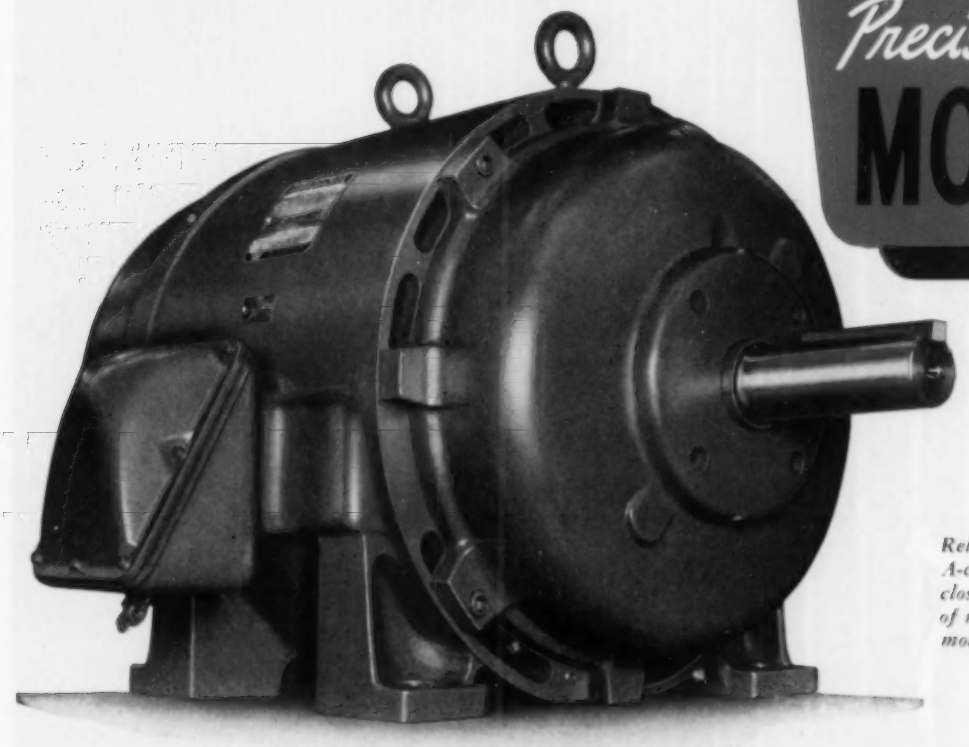
The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis Timken steels.

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

FOR RUGGED SERVICE...

"All motors are NOT alike!"

RELIANCE *Precision-Built* **MOTORS**



Reliance Totally-enclosed Fan-cooled A-c. Motor. All other standard enclosures available, with wide choice of mechanical designs and special mountings. Ratings from 3/4 to 300 hp.

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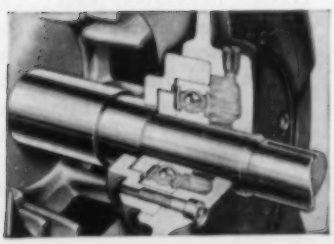

. . . AND THE BEST PRE-LUBRICATED BEARING DESIGN

The Reliance pre-lubricated bearing provides *four times more operating hours without re-lubrication* than any other bearing used in motors today. And—whatever your lubrication schedule—*you just can't grease 'em wrong!* To get the complete "inside story" on motor bearings, write today for Bulletin B-2201. It contains hard facts on the advantages of the Reliance pre-lubricated bearing design, with cutaway view, cross-section diagram, comparison chart, and statements by bearing manufacturers. B-1458 J

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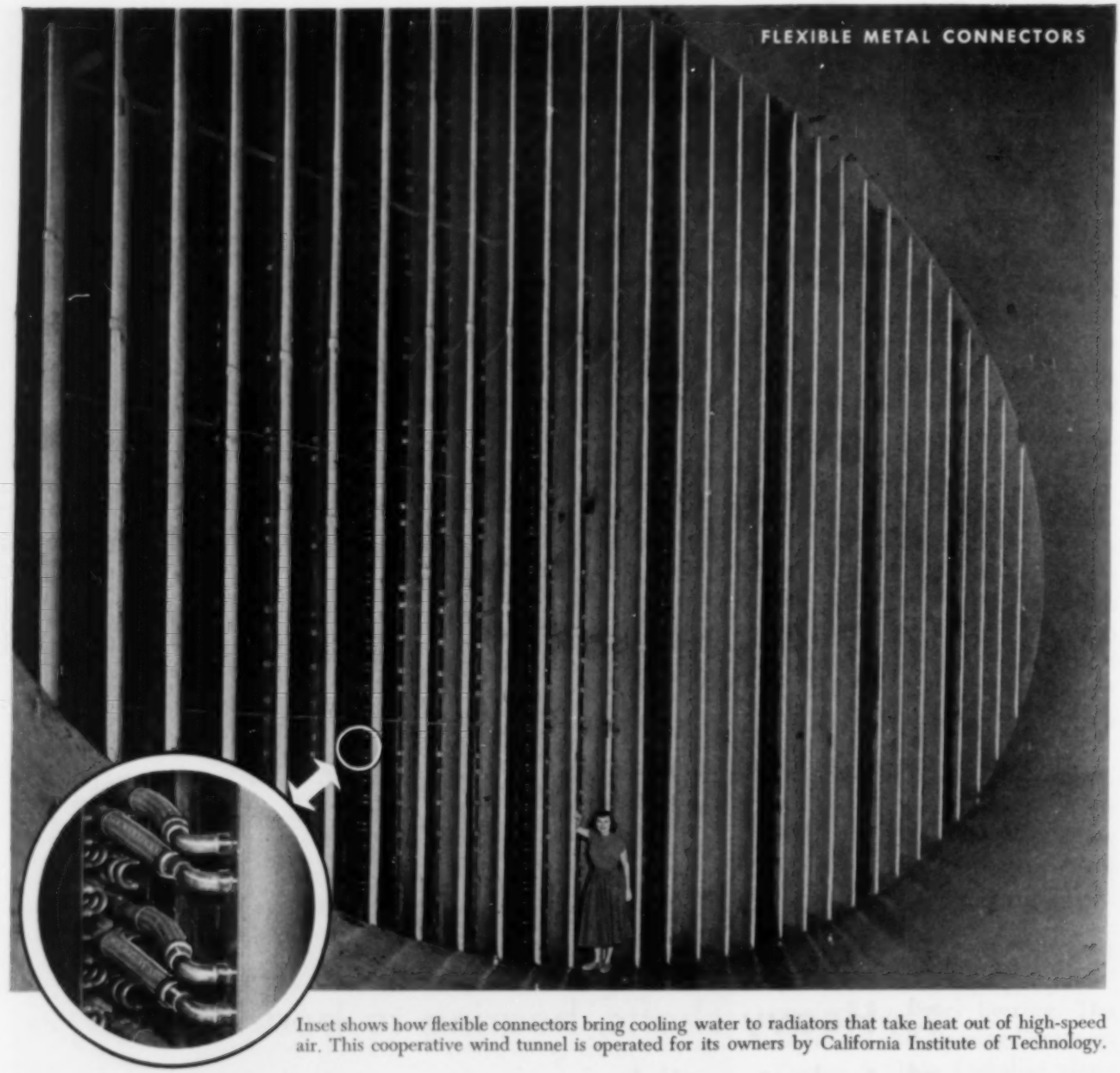

Inset shows how flexible connectors bring cooling water to radiators that take heat out of high-speed air. This cooperative wind tunnel is operated for its owners by California Institute of Technology.

650 Connectors help put the chill on fast-as-sound air

In Pasadena, Calif., five aircraft manufacturers jointly own this giant wind tunnel. There they test designs at air speeds as high as sound itself.

But, when you squeeze air to get such jet-age speeds, you also heat it up. So you look for a way to cool it off. Here they used a solid bank of finned cooling coils; but then they had to get cooling water to them through 650 piping connections. First, they had to consider aligning each opening; then expansion when temperatures rose and fell. And they had to keep the airstream bone dry. No leaks allowed.

They did it the easy way . . . with American Seamless Flexible Metal Connectors known as Vibration Eliminators. They had no trouble installing them. A solder-type connection made them permanently tight.

Maybe there's an idea here for you. American Flexible Metal Hose and Tubing have many uses . . . for connections that must move, bend, vibrate, connect misaligned ports . . . or piping in cramped spaces. They can safely carry almost any liquid, gas, chemical or semisolid. And you can get them in many alloys, sizes and types. Write for Catalog SS-50 to *The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Co., Ltd.*

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wherever connectors must move... ANACONDA American flexible metal hose and tubing

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An economical method for the continuous neutralization-disposal of waste pickle liquors has been developed* by the A. O. Smith Corporation.

This process based on controlled oxidation and conductance is available for all types of pickle liquors from steel plants and allied industries.

The Eimco Corporation, as exclusive licensees, manufactures complete package units; individually designed to handle large or small volumes of waste acid.

Write for complete information and literature to Eimco Process Engineering Division, 3319 South Wallace Street, Chicago, or your nearest Eimco Branch.

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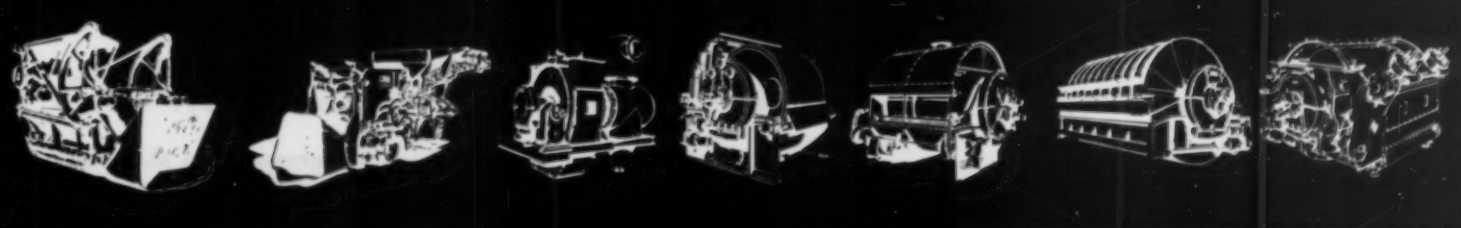

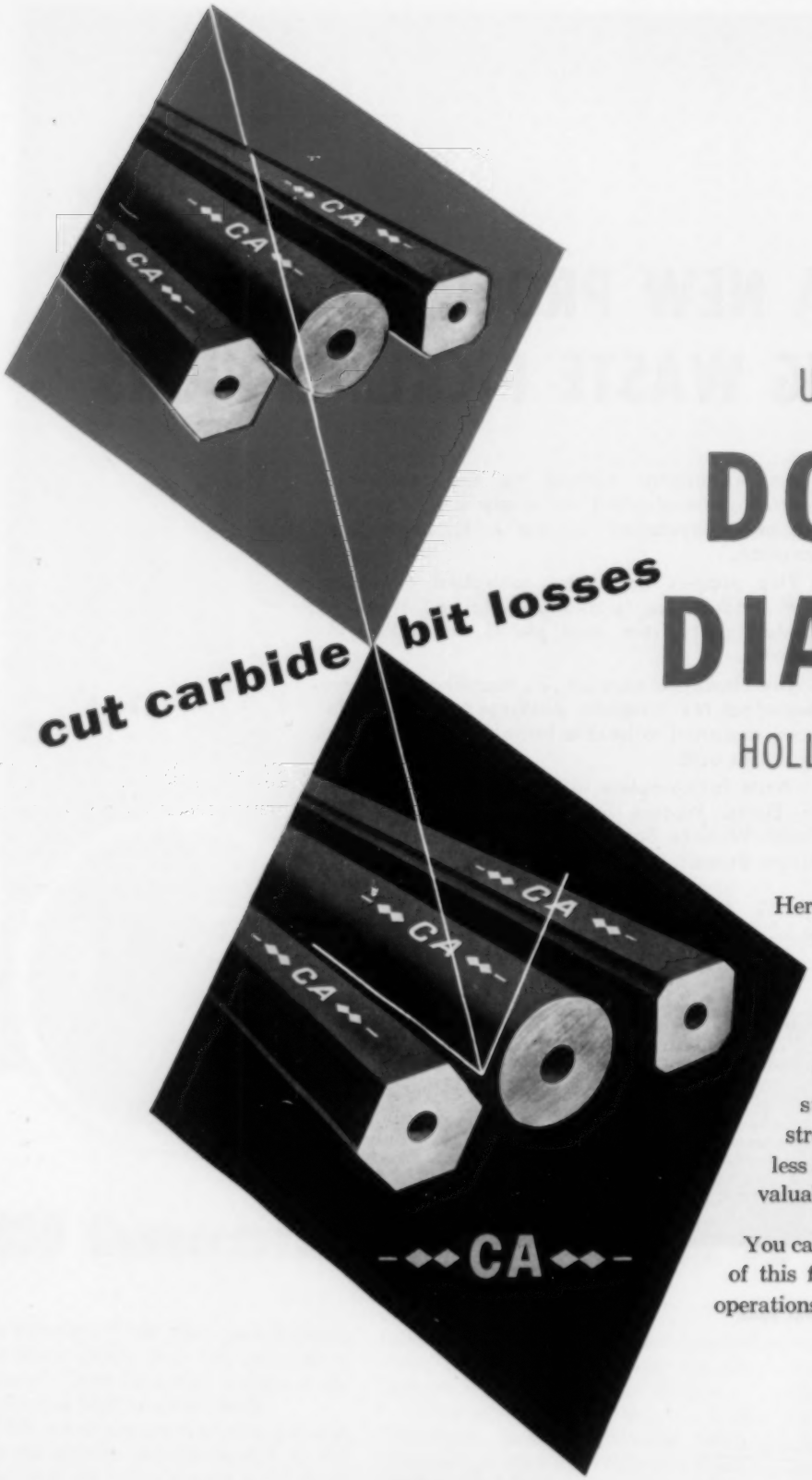

cut carbide bit losses

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HOLLOW DRILL RODS

Here's the finest, toughest hollow drill rod made. Crucible DOUBLE DIAMOND is made to tool steel specifications by the nation's leading producer of tool steels.

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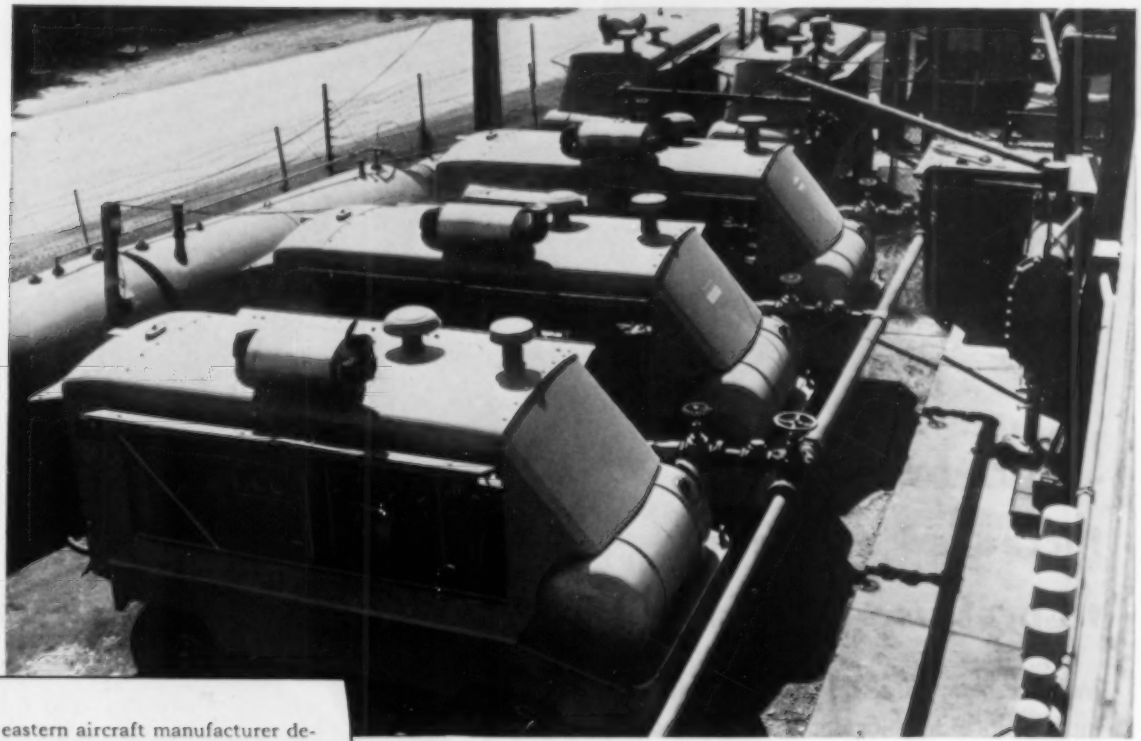

A large eastern aircraft manufacturer depends on these five 600-cfm GYRO-FLO portables to provide a continuous supply of compressed air for testing purposes, while permanent facilities are being constructed. Pressure is automatically maintained within 100 and 110 psi throughout the entire capacity range of compressors.

...with these five

GYRO-FLO ROTARY PORTABLES

Taking over a job, later to be handled by I-R *stationary* units, these five *portable* compressors supplied 3,000 cfm of clean dry compressed air on a nearly continuous schedule. Their performance under these grueling conditions has been completely satisfactory.

Such service-proved dependability of GYRO-FLO compressors has made them the most wanted compressors in the world today. This dependability is the result of GYRO-FLO's advanced rotary design—with only one fifth as many wearing parts as old style piston-type compressors. There are no valves to leak —nor are there pistons, rings, rods or clutch to wear out, replace, adjust or maintain.

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The continuous rotary action produces a steady flow of compressed air—free from pulsations or vibration.

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. . . are bringing increased efficiency to pressure blast cleaning

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ON THE COVER

WATER impounded in Harriman Reservoir on the Deerfield River in Vermont normally courses through turbines and turns generators that produce 45,000 kw of electrical energy for the New England Power Company's distribution network. At infrequent times when there is surplus water, it is discharged through a novel circular opening and creates a man-made cascade of rare beauty. The water drops into a tunnel that returns it to the bed of the stream below.

IN THIS ISSUE

SAVE for a narrow belt along its eastern coast, the mainland of Australia receives relatively little rainfall. Only in the southeastern area are the water resources capable of economic development. There most of the precipitation falls eastward of the Great Dividing Range and now flows into the Pacific Ocean, largely unused. The Snowy Mountains Scheme, described in our first article, is designed to conserve this water by diverting it to irrigable lands on the western side of the range. It is a bold engineering venture and one that will mean much to the growth of the commonwealth.

•

WHEN we are busy building up our armament, sheet mica is in demand and the Spruce Pine, N. C., area benefits because it is the center of the nation's largest deposits of high-grade mica. At other times Spruce Pine lives on its output of fine mica, feldspar and kaolin. They are its daily bread, so to speak, and sheet mica is its cake. The feldspar and fine-mica industries have had their ups and down, too, and have survived in the face of growing competition mainly because they have taken advantage of new means and methods such as selective flotation, Humphreys spirals and equipment for drilling and excavating raw ores. Part 2 of our Spruce Pine story starts on page 187.

•

MOST of the portable compressors that city dwellers see are used by the companies or municipal agencies that furnish them with gas, electricity or water. Compressed air is indispensable in the construction and maintenance of the facilities that dispense these services, and some single utilities have as many as 100 portable units in this work. The new Gyro-Flo 105-cfm rotary compressor, being more compact and lighter than conventional machines, fits on a small truck with room for tools to spare and is consequently proving both convenient and economical. Page 195.

Compressed Air Magazine

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ANNA M. HOFFMANN, *Associate Editor* J. J. KATARBA, *Business Mgr.*
J. C. PIERCE, *Assistant Editor* FRANCIS HARTMAN, *Circulation Mgr.*
A. W. LOOMIS, *Assistant Editor* WILLIAM HEINS, *Foreign Circulation Mgr.*
D. Y. MARSHALL, Europe, 243 Upper Thames St., London, E. C. 4.
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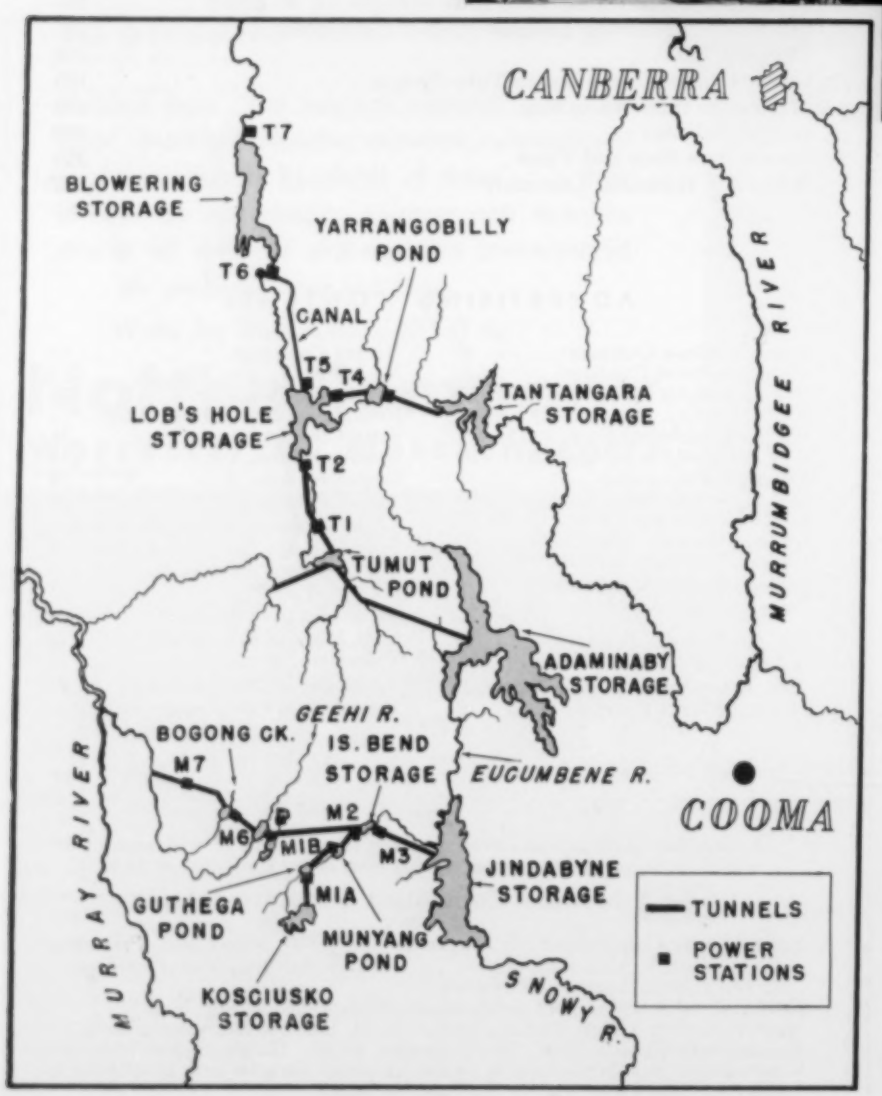
KEY TO OPERATION

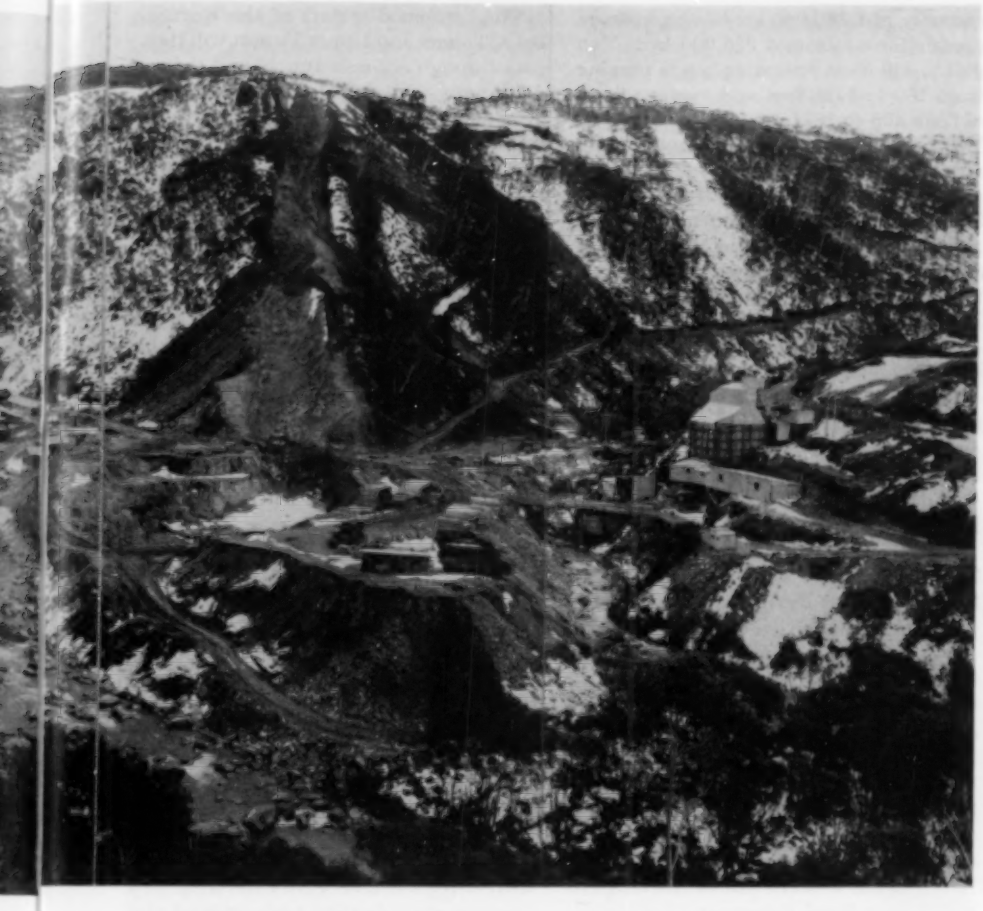
The bifurcated crest of the Great Dividing Range runs irregularly up and down through the area mapped below. In essence, the $700,000,000 project is designed to transfer water, mainly through tunnels, from the Upper Snowy River on the eastern slope to the headwaters of the Murray and Murrumbidgee river systems on the opposite slope. Both of the latter streams flow westward after leaving the mountains and traverse an agricultural area that needs additional water. Some of the diverted water will drop as much as 4000 feet within short distances, and advantage will be taken of its potential energy to generate electricity at sixteen points, most of which are indicated by small black squares. Those in the Snowy-Tumut diversion area, comprising roughly the upper two-thirds of the map, are designated with a "T," while those in the Snowy-Murray diversion range are identified by an "M." The section under development measures about 60 by 90 miles and is in southeastern Australia (see small map).



Snowy Mountains Project

Australia's Biggest Engineering Job Will Divert River Flow Through Mountains

Allen S. Park



PANORAMA AT MUNYANG

This is one of the centers where work is now being carried on under contract. It is equipped with stores, shops, a concrete mixing plant and accommodations for the engineering staff and workers. A transmission line runs into the area from Island Bend.

IN THE heights of southeastern Australia, part of the flow of a river is being transferred to the opposite side of a mountain range to increase the supply of irrigating water in a semiarid region below and thus bolster the production of much-needed crops. Moreover, as the transported water descends some 4000 feet in following its new course, it will be harnessed to turbines and thus made to produce enough electricity to justify the entire $700,000,000 expenditure involved. The boldly conceived undertaking will be the largest public work ever carried out in Australia and will rank among the major efforts of its kind in the world.

The Snowy Mountains Scheme, as it is called, embraces the construction of eight major dams; sixteen power stations, mostly underground; 86 miles of tunnels ranging from 16 to 44 feet in diameter; 490 miles of canals along the mountainsides to intercept runoff and carry it into tunnels or reservoirs; shafts up to 1100 feet deep; and hundreds of miles of highways and railroads, mostly in rough country. The development will eventually provide a generating capacity of approximately three million kilowatts and will divert annually more than 1,200,000 acre-feet of water. This, together with additional gains through better regulation of the flow will, it is expected, permit the raising of $70 million worth of additional crops each year which, in turn, will help to support a larger population and thus stimulate the economic growth of the commonwealth.

The operating principle of the scheme is the same as that of the Colorado-Big Thompson Project now nearing completion in the Colorado Rockies. However, the Australian undertaking will be on a much bigger scale with respect to the volume of water diverted, the amount of power produced and the number of elements involved in the engineering pattern. It is also similar to the Alcan Project in British Columbia, although the latter will utilize the diverted water solely for the generation of power.

The region undergoing development is located in the Australian Alps, which form the highest land mass on the continent, and includes the Snowy Mountains, so named because they are snow-capped five or six months of the year. Among them is 7300-foot Mt. Kosciusko, loftiest peak in the country. The combination of high ground that gives way rapidly to lower levels and abundant precipitation presents unusually favorable conditions for the generation of power. Equally fortunate is the fact that the area is situated about midway between Australia's two leading cities, Sydney and Melbourne, which, with their concentrations of industry, are in need of more power.

Four rivers rise in the Snowy Mountains, and three of them—the Murray, the Murrumbidgee and the latter's tributary, the Tumut—flow down the western side of the uplift. Then the two first-named pass through 500 miles of dry but fertile plains before they reach the coast. The streams carry only a small fraction of the volume of water required to grow crops on the available land. The fourth river, the Snowy, which originates in the highest part of the mountain range, receives the largest share of the runoff and flows in the opposite direction, eastward then south. It traverses northeastern Victoria, a district that has sufficient rainfall to grow crops without irrigation.

The essence of the plan is, then, to impound the waters of the Snowy and its tributary, the Eucumbene, at high elevations and divert them through tunnels under the mountains to the Murray and Murrumbidgee river systems. It is a long-range undertaking that will be developed in stages, but the benefits will begin to be felt relatively soon. It is expected, in fact, that generators with a capacity of 60,000 kw will be operating by 1954 and that step-by-step additions will bring the total to 500,000 kw by 1959.

Because the power to be produced will be readily salable, the farmers will get their supplemental irrigating water free of charge. An important consideration in respect to the hydroelectric aspect of the scheme is the saving of coal it will make possible. To equal the output of electricity when all the stations are in service, it would be necessary to burn 4 million tons of coal per year. It is also computed that the cost of developing the power will be some $26,320,000 less annually than if it were generated in thermal stations. Because the volume of water available will vary from month to month, the output of current will fluctuate correspondingly. Consequently, the hydro power will, for the most part, take care of peak loads, with steam plants handling the base loads.

The Snowy Mountains Scheme, in one form or another, has been talked about since 1884. The early proposals visualized only the potential benefits to be derived from irrigation, the generation of electricity being then in its infancy. However, a survey made from 1915 to 1918 included plans for producing 250,000 kw. These were revived in 1937 and again in 1944 when the New South Wales Government appointed a committee to investigate the project, with special attention to the need of diverting water to the Murrumbidgee River.

In 1946 all these preliminary efforts came to a head when the ministers of the commonwealth and of the states of New South Wales and Victoria jointly agreed that a committee of technical experts, representing the three governmental branches concerned, should investigate the matter of transferring water from the Snowy to the Murray. This committee, headed by Dr. L.F. Loder, recommended that the plans which had been considered earlier be broadened to include diversion of the waters of the Snowy to all three of the river systems on the western slope of the range. The report was approved by the conference of ministers in July, 1949, and legislation was enacted to establish a hydroelectric authority to implement the proposal. Bearing the name of Snowy Mountains Hydro-Electric Authority, it consists of three commissioners appointed by the Governor-General of the Commonwealth and drew up a program of procedure. To get the venture underway as quickly as possible, the body agreed to follow, in the main, the recommendations of the committee headed by Doctor Loder.

To expedite the beginning of actual work, it was decided to recruit technical help from overseas, it being the belief that an adequate staff could not be assembled in the home country without crippling the efficiency of engineering staffs of other Australian activities. Accordingly, advertisements were published in New Zealand, the United Kingdom, Norway and Sweden and an associate commissioner of the Authority visited those places to interview and select respondents. By June, 1951, more than 100 technologists, most of them engineers, had been employed abroad. In addition, 60 others who had heard of the impending scheme and made their way to Australia of their own volition were signed up after arriving. Because of the labor shortage in Australia, workmen were also hired abroad, and more than half of those paid by the day are immigrants. More urgent still was the need for craftsmen, and 650 of them were sought in western Germany where tests were given to determine the qualifications of applicants. By July 1, 1951, some 400 of them were on the job. A year later the Authority's payroll included 893 persons on salary and 2034 on wages.

Because of its numerous elements, the plan at first glance appears more complicated than it really is. For descriptive purposes, it can be divided into two parts. The first, generally known as the Snowy-Tumut Development, covers the diversion of the Snowy's tributary, the Eucumbene, to the Upper Tumut, a branch of the Murrumbidgee. It will add an average of 565,000 acre-feet per year to the Murrumbidgee for distribution to irrigated farms and embody seven hydro stations with an installed generating capacity of 1,360,000 kw but an average production of around 325,000 kw. The plants will have operating heads ranging from 160 to 1280 feet and average flows of from 405 to 1871 second-feet of water. Their load factors will vary from 17 to 48 percent.

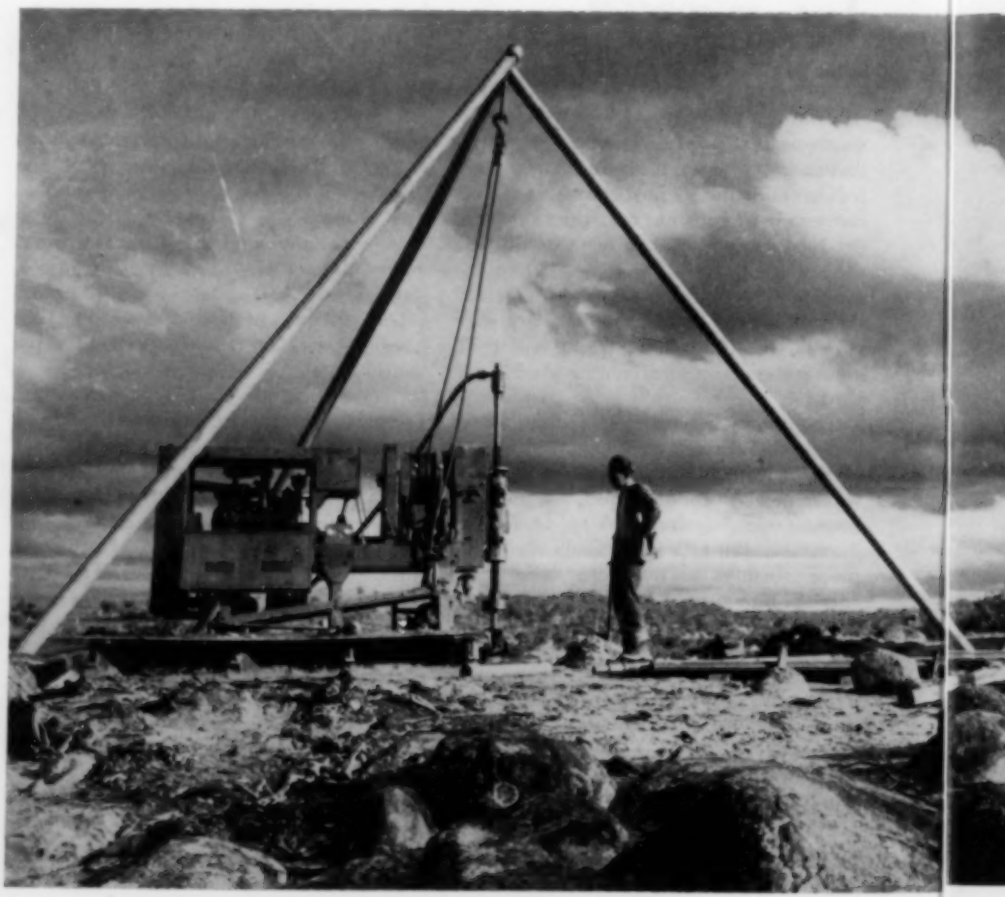
The second part, designated as the Snowy-Murray Development, involves the diversion of the Upper Snowy to the Swampy Plains, a tributary of the Murray, which will be augmented by about 700,000 acre-feet per year. It will include nine powerhouses which will have a total capacity of 1,760,000 kw but, because of the variation in the volume of available water, will have an average output of around 435,200 kw. Heads will range from 75 to 1420 feet, average flow of water from 79 to 2038 second-feet, and load factors from 17 to 41 percent.

To trace the operation of the Snowy-Tumut phase, we will start with a 380-foot-high earth dam at Adaminaby on the Eucumbene River. It will form a reservoir of 3½ million acre-feet capacity—the largest in the project. This basin will collect and store water for diversion through the main range via a 30-mile tunnel at a maximum rate of 3000 second-feet, delivering it to a 36,000 acre-foot regulating reservoir on the Upper Tumut. Another bore 4 miles long will convey water from the Tooma River on the western side of the range to the Tumut Pond Reservoir.

The combined waters of the Eucumbene, Tooma and Upper Tumut will then pass through a 2-mile tunnel and thence down a pressure shaft to power plant T1. The discharge will be impounded in a small basin created by erecting a weir on the Tumut and will flow from there through an 8-mile tunnel and down another pressure shaft to station T2. From there the discharge will be delivered to Lob's Hole Reservoir to be formed by damming the Tumut.

The main tunnel to be driven from Adaminaby through the range will be fitted with gates at the inlet and outlet so the water can be routed in either direction. The normal flow will be from east to west, but when there is surplus water in the Upper Tumut and Tooma rivers it will be directed westward through the mountains into Adaminaby Reservoir to be held until it is needed for irrigation on the western plains.

Water from the upper reaches of the Murrumbidgee will be brought into the Tumut system at the Lob's Hole Reservoir. An 8-mile tunnel extending through a spur of the range from a 350,000-acre-foot basin to be created by building a 150-foot dam at Tantangara will deliver it to a pressure tunnel leading to underground powerhouse T3. Leaving there, the water will pause briefly in a small pond on the Yarrangobilly River and then enter a 5-mile bore extending to a pressure shaft feeding underground sta-



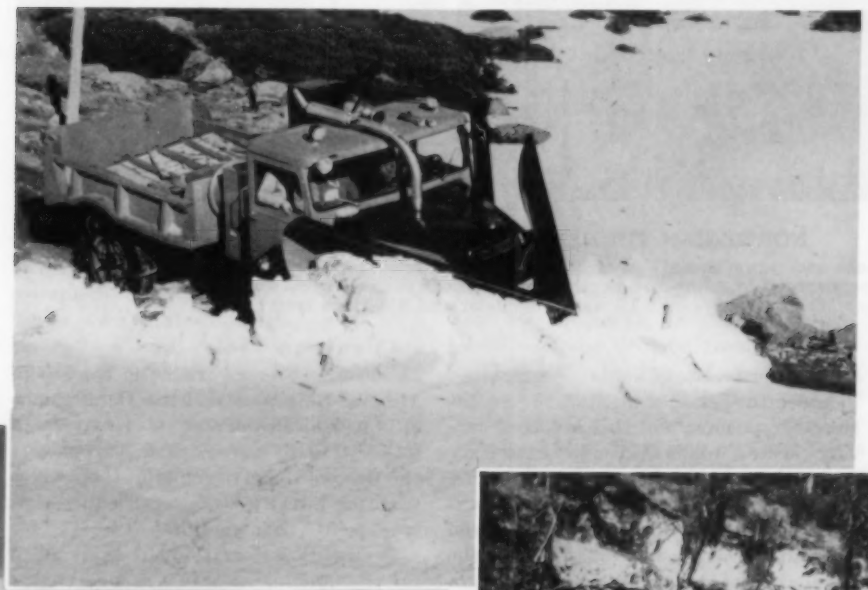
tion T4. From the latter it will flow into the Lob's Hole Reservoir which will be formed by rearing a dam to a height of 160 feet. The discharge from plant T4 will drop that distance into powerhouse T5 at the base of the dam.

From the tailrace, the water will pass into a canal following one side of the Tumut Valley. At the lower end of that channel it will flow down a pressure pipe to station T6, which will operate under 370 feet of head. Then the water will go via the Tumut to Blowering Reservoir, 13 miles downstream. This basin, to be created by an earth dam 280 feet high, will be built by the New South Wales Government. It will have a storage capacity of 846,000 acre-feet and will be the means of controlling the flow of irrigating water downstream. Upon leaving this reservoir the water will pass through powerhouse T7 and down the Tumut into the Murrumbidgee near Gundagai.

The Snowy-Murray system, like the Snowy-Tumut, consists of several elements. A 260-foot-high dam on the Upper Snowy at Jindabyne will form a reservoir of 1,200,000 acre-feet. A 22-mile tunnel will carry the water stored there westward under the mountains to Bogong Creek, where it will generate power at underground station M6. Next it will enter another bore 8 miles long and drop 1450 feet to the Swampy Plains River, tributary of the Murray. About 2 miles short of the discharge point it will pass through plant M7 which, with an installed capacity of 910,000 kw, is to be the largest one in the project. The Swampy Plains will deliver the water to the Murray, whence it will flow on to the plains for purposes of irrigation. The two tunnel sections in this phase of the development will vary from 25 to 44 feet in diameter and in some places will be 3000 feet below the surface.

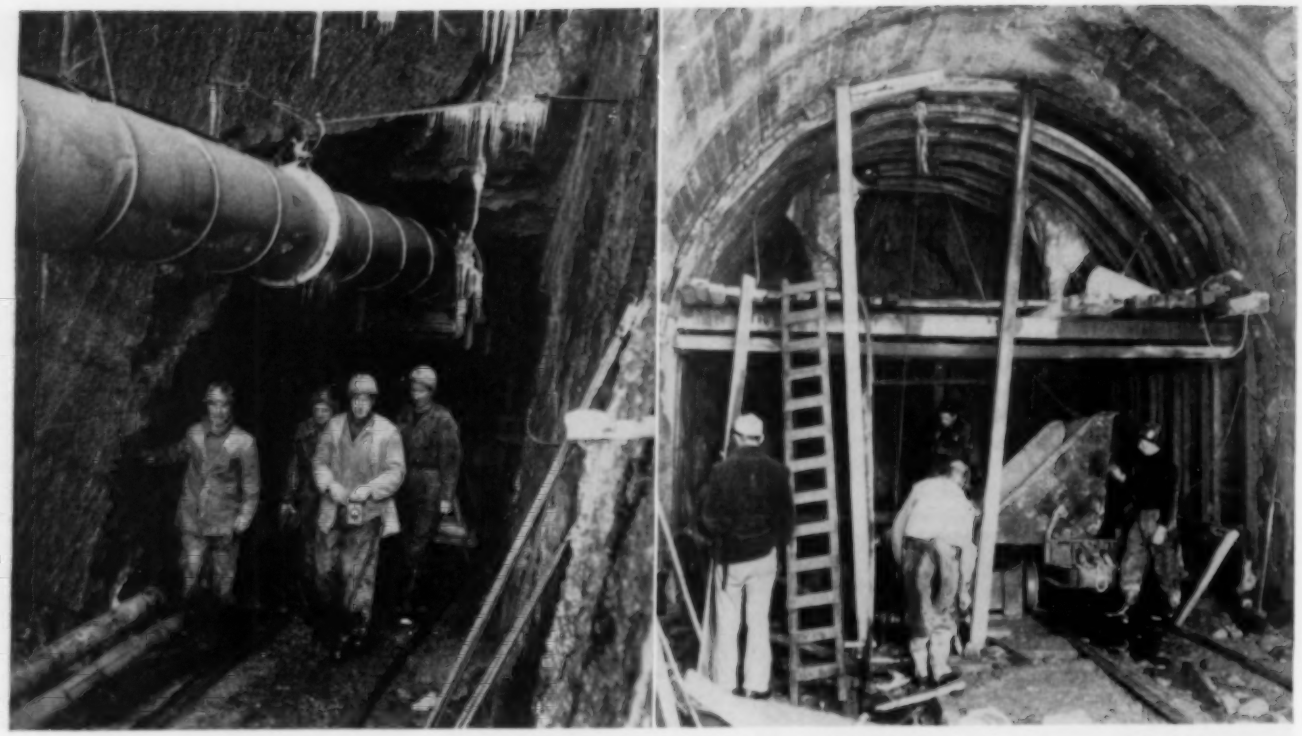
Two subsidiary schemes will direct and control the water in the upper reaches of the Snowy as it descends from around Elevation 7000 to 4000. Water taken from the river within 5 miles of its source will be carried by canal to Kosciusko Reservoir, the main storage pond. The outflow will pass through a tunnel to powerhouse M1A, go back into the Snowy and thence into Guthega Pond, which is now being created by rearing a small concrete dam on the stream. From the pond the water will flow through a second bore to station M1B and then into Munyang Reservoir. Leaving the latter, it will be directed through a third tunnel, through plant M2 and from there into Island Bend Reservoir. Finally, it will drop 1000 feet through a vertical shaft into the main Jindabyne-Bogong Tunnel. Powerhouse M3, of 250,000 kw installed capacity, will be located at the base of the shaft.

A second subsidiary scheme will harness the waters of Windy Creek and the Geehi River on the western side of the range. From a storage pond, water will fall 1230 feet—the greatest single drop in the whole project—to station M4.



PRELIMINARY WORK

Above is shown a jeep on an access road built into the Tumut Pond district and at the top a snowplow is clearing a road into the Kosciusko reservoir area in the southern part of the development territory. Nearby is Mount Kosciusko, highest Australia peak, with an altitude of 7300 feet. The view at the left pictures a diamond drill exploring foundation rock at the site of Jindabyne Dam.



NORWEGIAN TUNNELERS

The first contract covers a dam, tunnel and powerhouse (M1B) in the Guthega section and was awarded to a Norwegian firm. The view at the left shows workers coming out of an adit driven in to meet the tunnel line while the other one pictures operations in the tunnel, which will be about 19 feet in diameter and 3¼ miles long.

The discharge will be carried by canal to another storage basin, from which it will descend 780 feet to plant M5H. After pausing briefly in a small impounding reservoir, it will take a final plunge of 75 feet through powerhouse M5L and then pass into the main Jindabyne-Bogong Tunnel. Side-hill canals for intercepting runoff water and directing it into the various works of these subsidiary developments will have an aggregate length of about 100 miles.

To supplement the information on water resources previously gathered, studies in advance of actual construction included the establishment of 35 stream-gauging stations, and this involved cutting access roads through extremely rough country. Field work also entailed extensive surveying, much of which was done by men recruited overseas. Aerial photography was a helpful adjunct in the production of general area maps; geological maps have been prepared; and dam sites and associate structures are being investigated by means of percussion and diamond drilling. Wherever difficult foundation conditions exist, technical assistance is obtained from the Bureau of Mineral Resources and the Department of National Development. Key men in the Authority have visited Europe and the United States to acquaint themselves with the latest methods and equipment to expedite construction.

Preliminary operations likewise called for the opening of access roads and the building of shops and accommodations for workers at locations where construction activities were to be initiated. Cooma, on the eastern side of the mountains, is headquarters for the Authority, but much of the Upper Snowy development will be directed from Island Bend, where extensive living quarters and shops have been built. Included is a 3000-kw diesel power plant from which a transmission line was strung to Munyang and Guthega to meet job requirements. More than $5 million worth of plant and machinery has been concentrated at the principal operating centers.

In order to efficiently direct and coordinate the activities in the large area concerned, reliable communications facilities have had to be provided. In addition to telephone lines with private exchanges at Cooma and regional centers, a frequency-modulation radio network links Cooma with the main working sites and also with some motor vehicles, including ambulances. Contact is also maintained with survey parties and other mobile units by means of high-

SUMMARY OF SNOWY-TUMUT DEVELOPMENT

Station No.	Average Head Ft	Average Flow Cfs	Installed Capacity Kw	Average Output Kw	Load Factor on Installed Capacity
T1	1001	1088	320,000	79,000	25%
T2	920	1152	280,000	76,800	27
T3	1280	405	140,000	37,600	27
T4	990	522	160,000	37,400	23
T5	160	1750	110,000	20,300	18
T6	370	1871	50,000	24,200	48
T7	180	1853	300,000	50,200	17

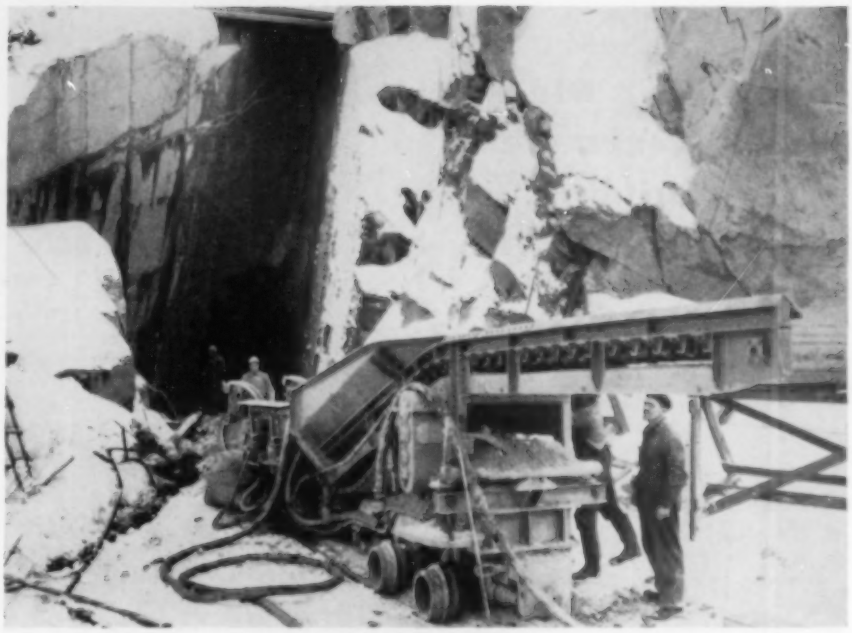
SUMMARY OF SNOWY-MURRAY DEVELOPMENT

Station No.	Average Head Ft	Average Flow Cfs	Installed Capacity Kw	Average Output Kw	Load Factor on Installed Capacity
M1A	530	361	60,000	13,800	23%
M1B	760	503	90,000	27,700	31
M2	740	79	25,000	4,200	17
M3	1000	838	250,000	53,500	21
M4	1230	229	50,000	20,400	41
M5H	780	341	65,000	19,300	30
M5L	75	826	20,000	4,500	23
M6	560	2029	290,000	145,600	27
M7	1420	2038	910,000	146,200	27

frequency radio. Cooma headquarters is connected with the Authority's offices in Sydney and Canberra by teleprinter.

The first step toward actual construction was taken in February, 1951, when tenders from bidders were asked throughout the world for what has become known as the Guthega Project. Bids were received from Great Britain, Norway, Germany, Italy and the United States, and in July, 1951, a contract was awarded to the Norwegian firm of Ingenior F. Selmer A/s. To lighten the drain on Australian resources, the contractor was requested to bring from overseas at least 90 percent of his machinery, staff and labor force. However, in advance of letting the contract, the Authority procured electric and diesel locomotives, compressors and some other heavy equipment for both tunneling and surface work and made it available to the contractor.

The initial contract covers the rearing of a concrete dam 100 feet high and 350 feet long on the Snowy River immediately downstream from its junction with the Guthega River; driving a pressure tunnel 3¼ miles long and approximately 19 feet in diameter; building penstocks from the downstream end of the tunnel to a powerhouse; and constructing the latter complete with necessary facilities to serve two turbogenerators and with space for a third. A tailrace and weir and roads and bridges to give access to the station when finished likewise are included. At the time the contract was let, another one was awarded to the English Electric Company, Limited, for the manufacture and delivery of two 30,000-kw generators and their Francis turbine drivers. To guard against delays in laying the penstocks, the necessary steel plate was also ordered from Europe.



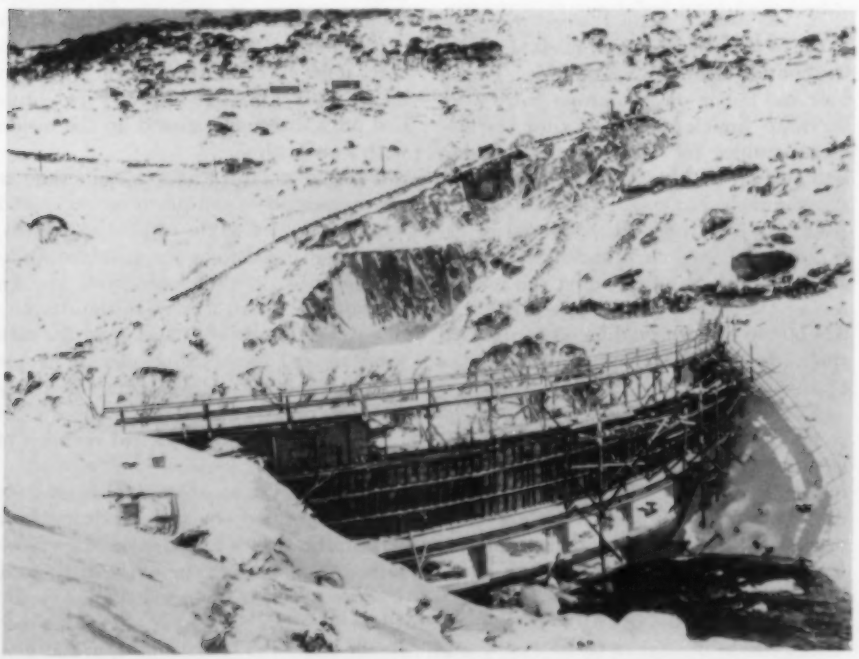
HEAVY ROCK WORK

Portal of the adit running into the Munyang-Guthega tunnel, showing the massive structure of the rock encountered. An Eimco loader, manufactured in the United States, is in the foreground.

The U.S. Bureau of Reclamation, foremost builder of irrigation works, is giving technical assistance on some phases of the Snowy Mountains Project under an agreement signed by the Australian and American governments in November, 1951. A group of Bureau engineers visited Australia in February, 1952, in the role of technical advisors, went over some of the area to be developed, and conferred with the Authority's directing engineers.

It was decided to ask the American agency to prepare designs and specifications for the Adaminaby-Tumut Tunnel, together with its appurtenant shafts, intake and control works; for the Tumut Pond Dam; and for the power tunnel extending from that barrier to the included surge tank. These are all in the northern part of the development area. In addition to rendering this direct aid, the Bureau also is giving technical training in the United States to selected Australian engineers who are sent there by their government. The arrangement with the Bureau will enable the Australians to take advantage of American experience and at the same time give the Authority's staff freedom to plan other parts of the undertaking that would otherwise have to be deferred for a time.

So as to get as early a start as possible on the American-designed section of the scheme, the Authority has done considerable advance work with its own forces. It has built access roads into the extremely rugged Tumut Valley, put down 50 diamond-drill holes to test the rock along the proposed route of the tunnel, and established a regional center at Tumut Pond with workshops, stores and accommodations for 300 persons. It has also begun operations on an 8x8-foot exploratory tunnel to be driven 1000 feet into the mountain to the site of the T2 station.

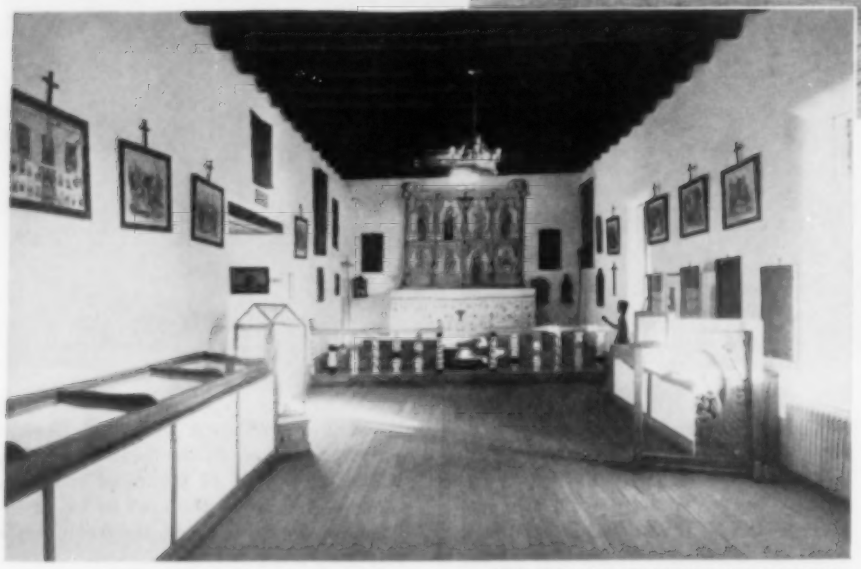


COFFERDAM

Winter view at Guthega dam site showing a cofferdam built to exclude water while the contractor laid the foundation for a concrete gravity storage dam 100 feet high and 350 feet long.

Nation's Oldest Government Building

Amy P. Hurt



NEW MEXICO STATE TOURIST BUREAU PHOTOS

NOW A MUSEUM

The only remaining section of the old palace faces Santa Fe Plaza. Its adobe walls are 58 inches thick. Its service as a seat of government ended in 1885, and it has been a museum since 1909. An ecclesiastical room is shown in the lower picture.

EARLY day visitors to the oldest governmental building in the United States, the Palace of the Governors in Santa Fe, N. Mex., were often startled to see festoons of human ears decorating some of the rooms. The dried ears were those of Indians killed by parties that were sent out by the authorities against the red men and were paid a certain sum for each head turned in. At that, the branch of the government controlling the northern section of the New World was a little more civilized than the one farther south, for in Chihuahua, Mexico, a great display was made of the entire scalps!

Originally intended as a residence for the Spanish governor, the palace was completed back in 1620, about the time the Pilgrims were landing on Plymouth Rock. The sprawling mass of native timbers and adobe mud successively became the seat of authority under three flags—the Spanish, Mexican and American. From the beginning the structure served a double purpose, that of governmental headquarters of a vast and trackless region and as a fortification against the Indians.

In the palace proper were the residence of the governor and his family and the council chambers and offices. To the rear and facing on a common patio were servants' quarters, barracks for the soldiers, stables for the governor's horses and those of the cavalry, a parade ground and other essentials. Still farther back was the presidio. The entire establishment was surrounded by a substantial adobe wall. Today, the section facing the Santa Fe Plaza is all that is left of the buildings which encompassed the town square in the days when the Spanish grandees ruled.

Even though its massive walls are of solid adobe, the palace is in a remarkable state of preservation. Almost three and one-half centuries of wind, rain, and Indian assault have scarcely left their mark. In the room east of the main entrance may be seen a part of the adobe wall that was exposed when the structure was renovated in 1910. It is nearly 5 feet thick, 58 inches to be exact, and shows two kinds of construction. The lower section is of coursed adobe, the type the Indians used before the coming of the Spaniards, and the upper part is of brick made of sun-dried adobe mixed with straw and laid in mortar. The latter building method was introduced by the Spaniards and is still practiced throughout the Southwest.

None of the original roof is left. It was probably burned during the uprising in 1680 when the Indians ran the Spaniards out of the territory and enjoyed independence until 1692. It is known to have been constructed of large pine logs topped by ax-hewn timbers laid crosswise and by a covering of earth. However, the ceiling of the entrance hall and the small rooms west of it were built before 1800, and in the original manner. A tree-ring expert found that some of the *vigas*—roof beams—date back to 1711-1721. Part of the original floors of smooth, packed adobe lies underneath modern wood flooring which was laid after the American occupation, when glass windows were also installed. In the early days crystallized gypsum served in lieu of glass, although ordinary dwellings had only shutters fastened on the inside with iron bars.

The old palace ceased to function as governmental headquarters in 1885 when a modern state capitol was built, but it continued to be the governor's residence until 1909 when the New Mexico legislature turned it over to the Archaeological Institute of America for use as a museum. Today, thousands of people pass through its ancient portals monthly to view its magnificent exhibits of archaeological and historical remains of the Southwest.

Probably the most distinguished governor who ruled the vast territory from within the palace was General Lew Wallace. Appointed to the office in 1878 by President Hayes, General Wallace spent three years in Santa Fe. While in residence there the famous author and general wrote the last three books of his classic novel *Ben Hur* in what he described as the "bedroom back of the executive office proper" in the palace.

The Spruce Pine Mineral Kingdom

Our Leading Source of Mica, Feldspar and Kaolin is Known to Few People

C. H. Vivian

Part 2

SPRUCE PINE BUSINESS SECTION

A view from high on a hillside showing the upper (left) and lower main streets that join at both ends. The Toe River flows at the right and the tracks of the Clinchfield Railroad curve upward along its bank.

THE Spruce Pine district's fine mica is of two kinds, dry-ground and wet-ground, and the term dry-ground is a little confusing. It originated when the chief source of fine mica was scrap that resulted from trimming and fabricating sheet mica. It was actually processed by dry grinding. Nowadays, however, most of the so-called dry-ground mica is a by-product in the recovery of either feldspar or kaolin by the flotation milling process, and flotation is a wet process. Credit goes to R.T. Dent and his father, along with W.B. Kester, for being the first to obtain fine mica during the refining of kaolin. Wet-ground mica differs in that water is added to it in the course of the grinding.

Dry-ground mica is used extensively in the manufacture of roll roofing and asphalt shingles, as an ingredient in rubber and oil-well drilling mud and for dusting adhesive substances to prevent them from sticking together or to some other material. And because it is decorative, it is also applied to countless products to make them sparkle.

Following World War II, about a dozen small washing and screening plants were put up to recover fine mica from highly weathered alaskite that was soft enough to be excavated easily. Almost all of them are still in service. They are usually located on the side of a hill to take advantage of gravity flow and above a stream. The feed material is loosened and washed into the upper end of the plant by hydraulic sluicing and the water for that purpose is pumped up by motor-driven units with an average capacity of 500 gpm against 500 feet of head. One setup is so high above the river that a 2-stage pump is required to lift the water 1000 feet.

Although they are known locally as jigging plants, these crude concentrators merely crush the alaskite and run it through a series of inclined cylindrical screens or trommels having openings of progressively diminishing size. There are usually four screens and three sets of rolls. The openings in the lowest screen are commonly ⅜ to ¼ inch in size, and material smaller than that gets away. It is estimated that the loss amounts to about half of the mica in the feed rock. However, the larger operators save this in Humphreys spirals, which were adopted after their effectiveness had been proved by experiments conducted by Dr. J. L. Stuckey, head of the geology department of North Carolina State College and North Carolina's state geologist. Concerns using them are Carolina Mineral Company, Newdale Mica Company, and English Mica Company in the Spruce Pine district and King's Mountain Mica Company at King's Mountain, N.C. Some of them also recover fine mica by flotation. Because of its shape and lightness, mica is very easy to float—in fact, will almost float in plain water.

POWER FROM NATURE

The leisurely traveler who gets back in the mountains may occasionally come upon water wheels such as the one pictured here. They provided power for all the old mills in the area.

QUARRYING ALASKITE

Just outside of Spruce Pine, Carolina Mineral Company produces daily about 900 tons of alaskite, a granitelike rock that yields soda feldspar, fine mica and quartz sand when crushed and put through a flotation mill. At the left is a general view of a quarry face and, below, a close-up of Luther Blevins and the Ingersoll-Rand wagon-mounted drill that puts in all the blast holes. From one position, as shown, it drills nine holes arranged fanlike in a vertical plane, and then moves over 6 feet and repeats the performance. While drilling is in progress in one section, broken material is being loaded in another (bottom view). A venerable Ingersoll-Rand belt-driven duplex compressor (opposite page) furnishes air for the operations. S.B. Stamey is standing beside it.

Mica is wet-ground in batches of up to a ton each, and the process ordinarily takes from four to eight hours. Wide-rimmed wheels faced with end-grain wood blocks and mounted at both ends of a horizontal shaft travel round and round and crush the material against a vat floor made up of similar blocks. This generates heat, and water is added a little at a time to prevent burning the mica. The ground mineral is sluiced to a settling tank, where it remains for 24 to 36 hours. There wood and other floatable impurities rise to the top and are removed. The slurry is then stirred mechanically and pumped to a filter for dewatering. The cake from the filter is dried in a steam-jacketed vessel, graded for size and sacked.

The English Mica Company produces wet-ground mica of two sizes at Spruce Pine. Material processed as just outlined is classified into 160- and 325-mesh sizes by passing it through silk screens. Some of it undergoes the additional treatment of micronizing, or attrition grinding. Propelled at great speed inside of a circular chamber by high-pressure superheated steam, the particles wear one another down to a state of pulverization in the melee of multiple millions of collisions. Two grades, equivalent to 1000 and 3000 mesh, are turned out.

The wet-ground and micronized particles, despite their smallness, still retain the characteristic platy structure of mica and, when incorporated in paint, they overlap one another like shingles on a roof, giving good coverage that thwarts checking and cracking. As a result, mica-bearing paint provides good protection against corrosion and is often specified for metal surfaces exposed to air containing salt or chemicals. Sometimes mica is added to paint in which there is aluminum and blends well with flakes of that metal. In paints for traffic marking and similar services, the light reflecting property of mica is important. Almost all paints could be improved by the addition of mica, but that would make them too costly for ordinary application. Furthermore, the tonnage required for that purpose is not available.

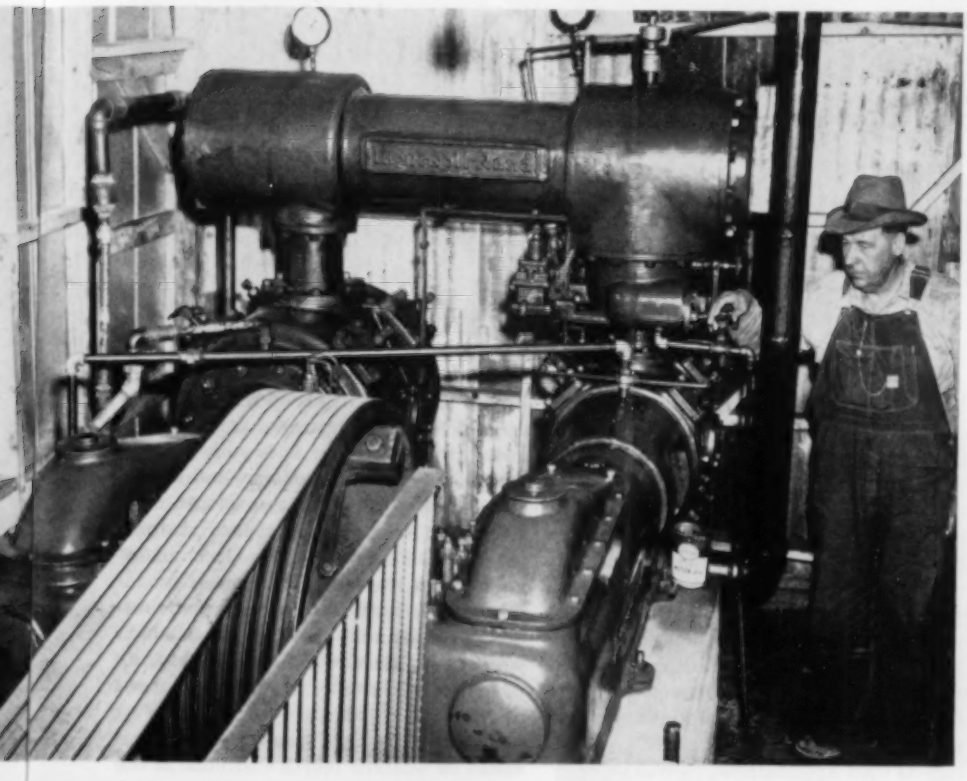
PHOTOS BY JOHN ROBINSON

Kaolin, a soft, earthy substance, is a hydrated aluminum silicate. Although it is smooth to the touch, it contains crystalline scales too tiny to be clearly seen under an ordinary microscope. In the kaolin group of minerals are six that are identical in composition but differ in crystalline structure. They can be identified by X-ray examination. One of the

most prominent varieties, kaolinite, is traditionally believed to be a product of particles of other minerals, especially of feldspar long exposed to weathering. The kaolinizing process is supposed to be promoted by carbonic and humic acids, which might have been supplied in the district by decaying dense vegetation such as the stands of rhododendron and laurel that flourish there. Another theory is that the action of circulating hot water is responsible for the origin of kaolin.

But regardless of how it was formed, the Spruce Pine kaolin is definitely considered to be residual or primary, meaning that it was created where it now rests. This is reputed to be the only place in the Western Hemisphere where kaolin of that type is obtained in appreciable quantities. It is relatively free from impurities and can be processed economically. The remainder of the output of the United States is secondary or transported kaolin, which requires washing to remove iron and other contaminants and sells at $3 to $9 a ton, as against $21 to $22.50 for primary. It is not produced in the district.

Primary kaolin has many applications in industry, and is probably best known as an ingredient in fine china for which secondary is not suitable. The latter serves mostly as a filler and sizing in



coated papers, some 762,000 tons having been used for that purpose in a recent year. Other large consumers of primary are makers of rubber goods and refractories. Lately, large quantities of it have been going into fiberglass which it supplies with the necessary alumina. Kaolin has certain other undetermined characteristics that make it superior to hydrate of alumina, which it is replacing. It also enters into cement, ceramic tile, fertilizers, various chemicals, calcimine and linoleum and serves as a paint filler or extender. It is likewise mixed with graphite, a minor but common use, to form the "lead" in pencils.

Kaolin, like mica, is said to have been mined by the Indians in North Carolina and exported to England in the early part of the seventeenth century. Around 1767, Josiah Wedgwood, member of the famous family of English potters, sent one of his men, T. Griffiths, to Ayoree Mountain, located about 100 miles southwest of Spruce Pine in Macon County, to obtain white or china clay, as the British called kaolin. He cleared out an old pit from which the Indians had apparently taken clay "long before" and loaded five wagons with a ton each. After much difficulty, he reached Charleston, S.C. and shipped the material to England. It is thus established that the first fine dinnerware made from American clay was produced in Great Britain.

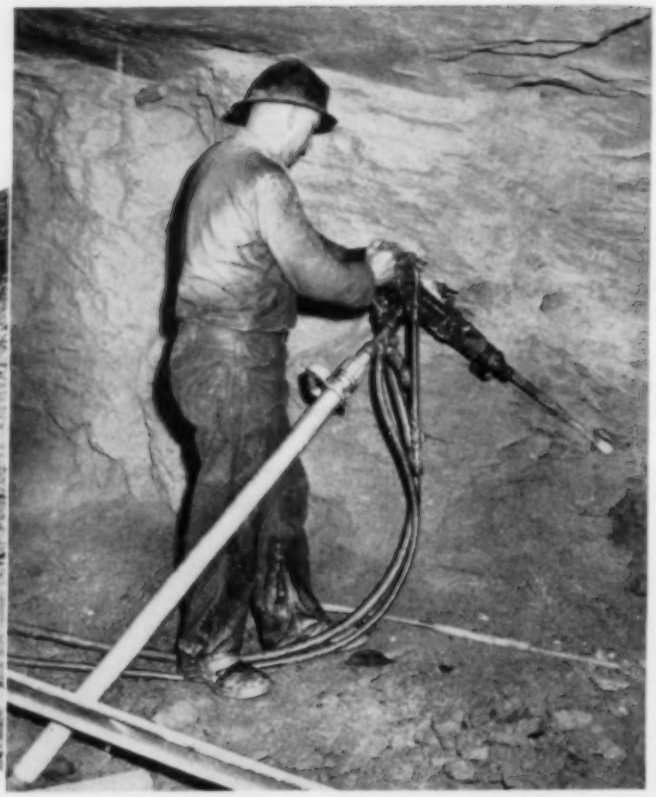
Modern kaolin mining also had its beginning in the general region just mentioned, but not until 1888. It was continued in Jackson, Macon and Swain counties until about 1920, by which time the deposits had been practically exhausted. The first extraction of consequence in the Spruce Pine district was at Bear Creek near the North Toe River by C.J. Edgar Company in 1905 or 1906, immediately following the building of a railroad into the area. The workings were abandoned after twelve years, but later were reopened. In 1918 five properties near Spruce Pine were being operated. For the past 35 years the district's kaolin output has been valued at from $100,000 to $400,000 annually.

Most of the early potteries in America were started by Englishmen, and their formulas called for the use of British clays. As the latter cost little or no more than the domestic material and was of good quality because it had been carefully mined, it gained a strong foothold in that industry. According to U.S. Bureau of Mines technologists, American kaolin is purer than the English because it contains less mica, but for a long time our producers were careless in their mining methods and that didn't help their cause. During World War I, when imported clay was hard to get, they made some headway, but when peace returned shipments from abroad went up again, and during the 1920's amounted to as much as 400,000 tons a year. They fell off once more during the second war, and domestic miners and processors meanwhile improved their technique and began selling a superior product that satisfactorily answers the potter's needs. As a result, imports have not regained their former proportions and are down to less than 100,000 tons per annum.

The kaolin deposits are found in the lower-lying sections of the area, especially along the main stream valleys. It is necessary, of course, to get rid of the unwanted minerals, and that is done by a combination of grinding, washing, screening and flotation. The last-mentioned process was introduced by the Harris Clay Company and worked out by its technical staff with the assistance of the Tennessee Valley Authority and the Bureau of Mines. Harris Clay has been active in the district since 1907 and now accounts for all the kaolin production. Mining of the crude kaolin matrix

ELK MICA MINE

Modern equipment is required for profitable mica mining. This combination consisting of an Ingersoll-Rand portable air compressor and a Jackhamer mounted on a Jackleg for easy holding is used in the Elk Mine at Plumb Tree.



PHOTOS BY JOHN ROLINSON

is simple, as it is soft enough to be excavated by power shovels without the necessity of blasting. It is hauled to the treatment plants in trucks.

In 1945 the possibility of using kaolin from the section as an aluminum ore was investigated by the state. It was determined that between three and seven million tons of material in three large deposits located 175 miles from aluminum reduction works at both Alcoa, Tenn., and Badin, N.C., could be considered potential sources of ore provided a satisfactory commercial process could be developed for the extraction of the alumina content. That, however, was not accomplished. It is roughly estimated that around 50 million tons of recoverable kaolin remains in the district.

Feldspar, ordinarily ranging from gray to white, is the commonest mineral in crystalline or igneous rocks. One authority has computed that the proportion amounts to 59.5 percent, as compared with 12 percent for quartz. It serves as a fluxing or fusing agent in chinaware, but is utilized most extensively in glassmaking. Fortunately, it was present in the clays used by early potters, who probably weren't aware of its identity or its action. The Chinese first added it as a separate ingredient during the Tang Dynasty (621-945), and it is claimed that no good china was manufactured until its function was noted and its proportion controlled. Porcelain was not made in Europe until 1709, and no feldspar was produced there prior to that time. A mine that was opened in Sweden in 1780 was still being operated in 1925.

Feldspar is defined by the Whiteware Division of the American Ceramic Society as "a group of minerals consisting of aluminum silicates of potash, soda and lime, in which one base generally predominates." No one of the minerals is commonly found alone, and there is usually an intergrowth of at least two varieties, plus accessory minerals such as quartz, mica, garnet, tourmaline and some kaolinite. The potash and soda feldspars are the most abundant and the most important commercially. Each has its own applications, as will be seen later.

The first feldspar mined in the United States came from North Carolina and was shipped to England in 1744. The earliest mill for grinding the mineral was built at the Toll Gate Mine in Connecticut about 1850. The mill stones were turned by oxen. Since 1880 records have been kept of domestic output, which ranged between 6000 and 18,000 long tons until 1898, when it jumped to 27,000 tons following the discovery that the material improved the action of scouring soaps. Its use in making artificial teeth —a minor application—dates from 1883. In 1896 it was established that alumina is a valuable constituent in glass, and by 1924 manufacturers of containers of that type generally added feldspar to supply that element. Grinding it into poultry grit began about 1900, and twenty years later that product consumed 20 percent of the yield. In 1907 the mineral became a binder for abrasive wheels.

Our annual output of feldspar runs around 500,000 long tons, and approximately 99 percent of it is consigned to the glass, enamel and pottery industries. Glassmakers alone take about two-thirds and are now using it for flat products as well as containers. It is an ingredient in the gleaming enamel on refrigerators, bathtubs and other household articles and in the dishes from which we eat. In glass, which it toughens, its proportion is usually around 15 percent of the sand content.

Feldspar mining sprang into prominence in western North Carolina in the 1920's. Mica had been produced there for 50 years, and as the two minerals are commonly associated, the miners knew where the spar was. When several feldspar dealers put in wagon scales at railroad sidings and offered to buy the mineral, it was not long before loads began coming out of the hills. At first this happened chiefly in winter when farmers had time to dig it out. Then some of them found that they preferred mining to farming, or that they did better at it, and so made it their year-round occupation.

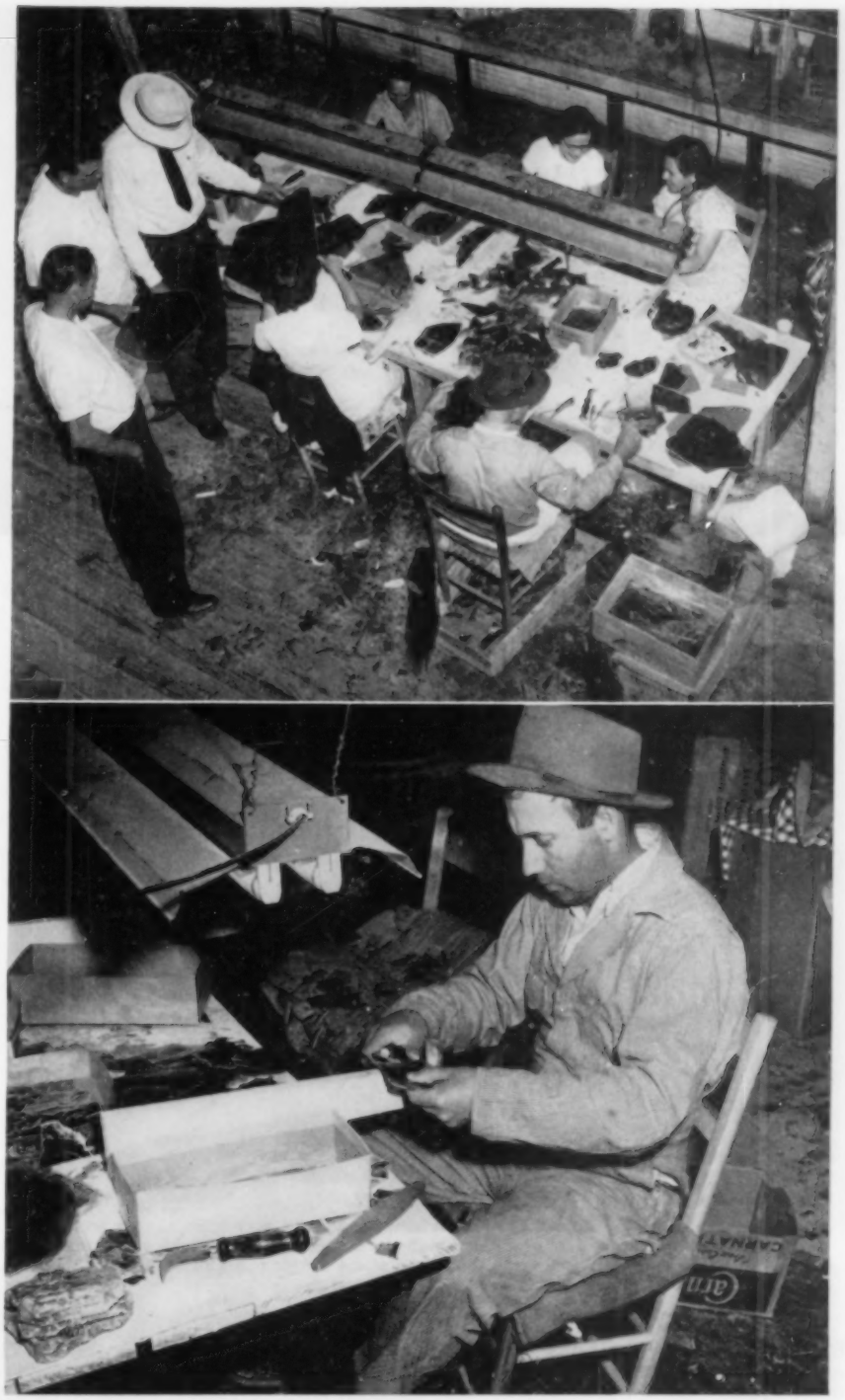
In those early days, mining was generally done with hand-wielded tools, and mechanical drilling, hoisting and pumping equipment did not appear until workings gained in depth. Between 1932 and 1940 most of the properties were taken over by the larger operators, and now there are fewer independents. Portable compressors were introduced for both prospecting and production, with bull-

dozers proving useful for removing topsoil. Most of the workings were (and still are) open cuts or quarries.

Before marketing, the spar was cobbed to remove quartz, garnet and other unwanted minerals. The buyers ground it in pebble mills until the 1920's when glassmakers began to object to the dust that was included. Processors then turned to roll or cone crushers provided with magnetic devices to extract tramp iron. As consumers became more particular about what they would accept, the Tennessee Mineral Products Company established a chemical laboratory in 1923. That was the first effort to make a uniform product and to limit the impurities by scientific control. In 1930 the industry adopted the first standard ever drawn to cover a mineral or natural raw material. Three grades of feldspar are now recognized by buyers and sellers. They vary as to the ratio of potash to soda and the silica and iron contents.

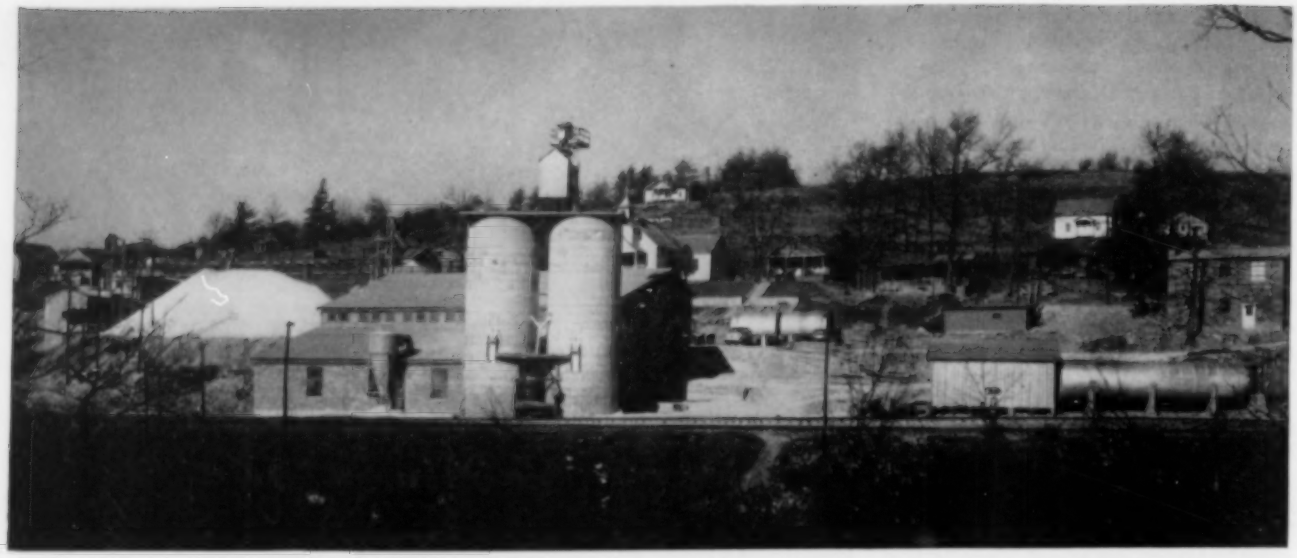
Until about 1940 substantially all the Spruce Pine feldspar came from pegmatite dikes, in which it is found together with quartz and minor minerals. As the known high-grade deposits were worked out and fewer new ones were discovered, increasing attention was given to the abundant sources of alaskite. However, existing methods of concentrating and purifying feldspar were not well adapted for handling that material, especially in view of the fact that users of feldspar were becoming progressively more exacting about its chemical composition and drawing up specifications that were harder and harder to meet. Under those circumstances, competitive materials such as nepheline-syenite from Canada and aplite gained some acceptance, and it was clearly up to the feldspar producers to do a better job or suffer accordingly. Fortunately, by turning to froth flotation, they were able to improve their product materially and maintain their former position.

The process, which saved the industry in the Spruce Pine area, separates and recovers feldspar, mica and quartz by use of suitable reagents. It was worked out by Consolidated Feldspar Corporation in its laboratory at Erwin, Tenn., near Spruce Pine. A pilot plant was established at the same location and succeeded in raising the output to a carload a day, which virtually put it in the commercial-producer class. The great difficulty that had to be overcome was finding a way to separate the feldspar and quartz, which acted so much alike that it was impossible for a long time to float one and keep the other down. That was finally achieved, but even now those in the business are reluctant to tell what reagents they use or to discuss details about their flow sheet. The first commercial-scale flotation mill was built by Consolidated's subsidiary, Carolina Mineral Company, at Kona, a few miles from



TRIMMING MICA

A maxim of the mica-mining business is that the money is made or lost in preparing the raw material for market. Most operators maintain a "mica house" where the crude crystals or blocks are cobbed to remove extraneous matter and then split or "rifted" with a knife into sheets ranging in thickness from 0.007 to 0.125 inch. The sheets are then trimmed to remove edge imperfections. Of the 800 sheet-mica workers in the district it is estimated that 600 are engaged in rifting and trimming. At the top is the interior of the mica house of Yancey Mines, Inc., showing sheets up to 16x28 inches in size. Great skill is required to trim mica quickly and efficiently. The trick is to remove cracks, inclusions and other imperfections and still leave as big a piece as possible. Workmen in India are adept at this. They trim all sides and bevel the edges to facilitate further splitting. In this country from one to four edges may be trimmed, and occasionally an edge defect may be removed by thumb pressure. Where electrical pieces are being stamped out of small-size sheets, partly trimmed mica is preferred because it gives the operator more to hold on to during the punching cycle. The trimming knife has a short blade with a curved cutting face. The trimmer, James Carpenter, in the lower picture holds a sheet nearly horizontal and draws the knife toward him. After cutting through the mica, the blade is stopped by the small upright past.



FELDSPAR FLOTATION MILL

A modern plant on the outskirts of Spruce Pine, which is designed to produce hourly 10 tons of feldspar, along with mica and quartz sand, from about 20 tons of alaskite feed rock.

MICA JIGGING PLANT

One of about ten of the district's hillside washing and screening plants which recover fine mica from unconsolidated material that is sluiced in at the upper end. The finer flakes of mica get away, but some of the larger operators save them by using Humphreys spirals after the so-called jigging operation.

Spruce Pine, in 1945. Since then two more have been constructed, both in Spruce Pine: one by the Feldspar Flotation Corporation in 1947 and the other by Carolina Mineral Company in 1950.

By turning to alaskite as a source of feldspar, the industry is reaping extra dividends because mica and quartz have become important by-products. In fact, all feldspar and kaolin plants yield fine sizes of mica, and feldspar float mills save the quartz, which is of high purity. The interdependence of feldspar and mica is so pronounced that some operations could not be carried on profitably if they did not have this double source of revenue. Sometimes it reaches the point where it is almost impossible to tell whether a certain plant is chiefly a feldspar or a mica producer. As to the kaolin industry, while it may not need supplemental mica to keep it going, it could not meet English competition without its income from fine mica. Actual output statistics are difficult to obtain, but it is reported locally that Harris Clay Company is close to the top among the district's suppliers of dry-ground mica.

The three feldspar flotation mills are the only ones operating in the United States and all are in Mitchell County. The one at Kona is reputed to turn out more feldspar than any other in the world and also produces mica and quartz. Feldspar recovered by flotation is used chiefly in making glass and semivitreous tableware. Three dry-grinding plants also are active: a unit of the Carolina Mineral Company mill at Kona, the Feldspar Milling Company's establishment at Bowditch and the North Carolina Feldspar Producing Company property at Erwin. Their product enters into high-temperature-fired tableware, ceramic tile, sanitary ware, glass and pottery.

The feldspar that feeds the flotation mills is mined on a large scale, but a great deal of the mineral that is dry-ground is still obtained from moderate-size openings sometimes by one man or a small group. They extract the feldspar from the surrounding pegmatite, usually by patient hand methods, and then cob the chunks with hammers to knock off any unwanted material. They work independently and sell their product to one of the processing mills.

Although feldspar is not a strategic mineral, the amount mined is definitely affected by wartime conditions. This is attributable to the fact that tin, which we don't produce and therefore have to import, invariably becomes scarce in times of national emergency, thus stimulating the manufacture of bottles to replace tin cans. It will perhaps be recalled that the coffee we bought during the last war was packed in glass and that not much canned beer was available.

During a war economy, then, there is a marked increase in the demand for the kind of feldspar—the soda-containing variety—that is used in making glass and some white pottery. When the Korean emergency arose, Consolidated Feldspar Corporation, the nation's largest soda-spar producer, had so many calls for the mineral that it decided to enlarge the facilities in the Spruce Pine district of its subsidiary, Carolina Mineral Company.

As a result, the latter built a flotation mill on the outskirts of Spruce Pine and opened a new deposit of alaskite to supply the raw material for it. Because of the urgency of the need for expansion, the facilities were in operation ten weeks from the time it was decided to provide them. On the other hand, war does not call for more potash feldspar, which goes mainly into pottery and porcelain. In fact, the output of those wares usually drops because of the lag in residential construction.

About 95 percent of the soda spar of commerce is produced by flotation because it is the major constituent of the feldspar in the alaskite deposits that occur in such large bodies that they can be economically worked by conventional quarrying or open-pit methods. Potash feldspar, on the other hand, is still obtained by selective mining of the pegmatites, though one operator is turning out a controlled percentage by a complicated method of flotation. Cobbing removes virtually all the impurities, and when the material is delivered to the mill it requires only grinding to prepare it for the market. It is dry-ground to 200 mesh, whereas soda spar obtained by flotation is reduced to only 20 mesh. The greater difficulty experienced in mining potash spar is reflected in its price, which currently ranges from $16 to $18 per ton, as compared with around $12 for soda spar.

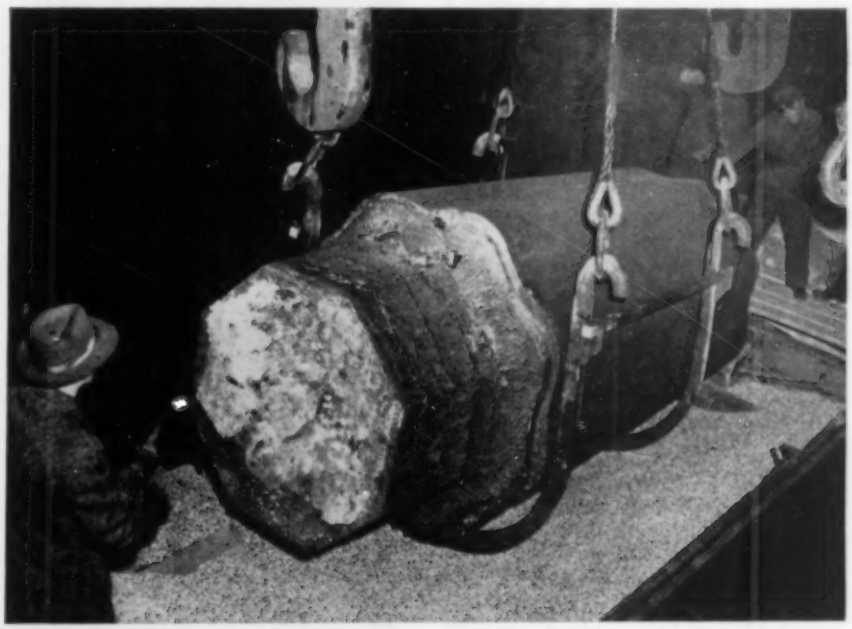
In feldspar flotation the dark minerals —usually biotite mica, garnet and hornblende—are carried off together. Ordinarily, no effort is made to separate them and they are discarded. Garnet from some localities is salable for use in manufacturing abrasive paper, but the Spruce Pine product is not hard enough for that.

The sand that is segregated is equivalent to approximately 30 percent of the original rock. It is of high quality, being nearly all quartz. It is of the kind favored by glassmakers, but there is a market for it for that purpose only where freight rates are favorable. Most glass plants are located near a source of silica, and Spruce Pine is close enough to only a few to compete successfully.

Alaskite is quarried by benching, but the drilling procedure differs from that followed in most quarries. Because the practice at the Carolina Mineral Company deposit near Spruce Pine is fairly typical of that throughout the area, a description of it will suffice. A working face from 20 to 40 or more feet high is developed and holes are drilled into it from the side rather than the top. An Ingersoll-Rand X-71 drifter on an FM-3 wagon mounting is set up at the base or toe of the perpendicular face and nine holes

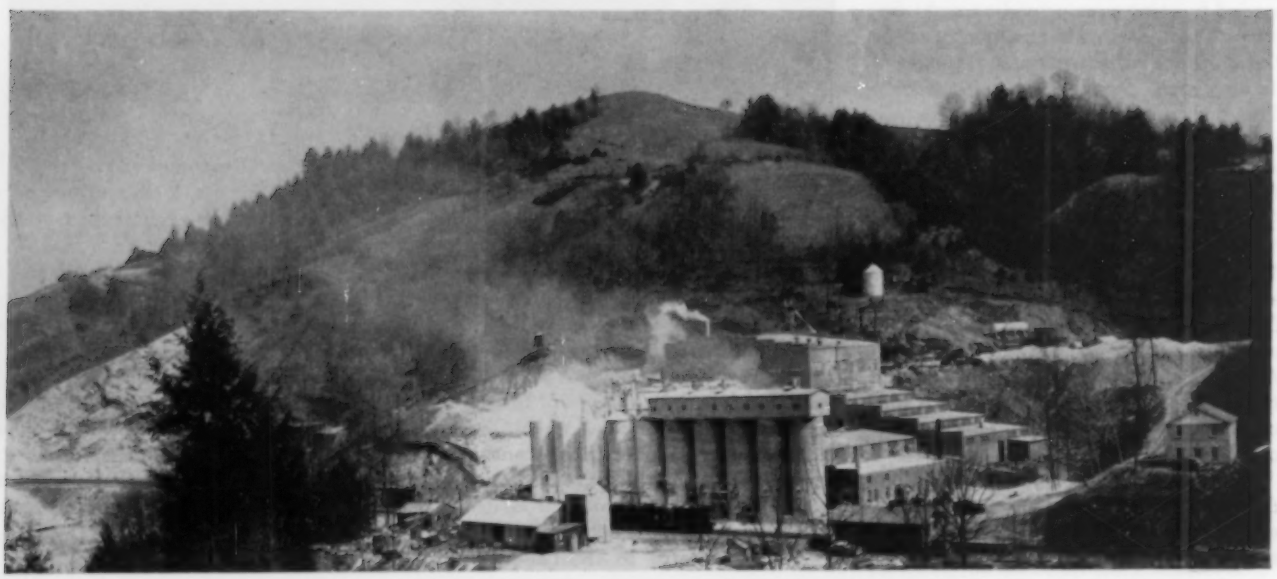
KEEPING IT WARM

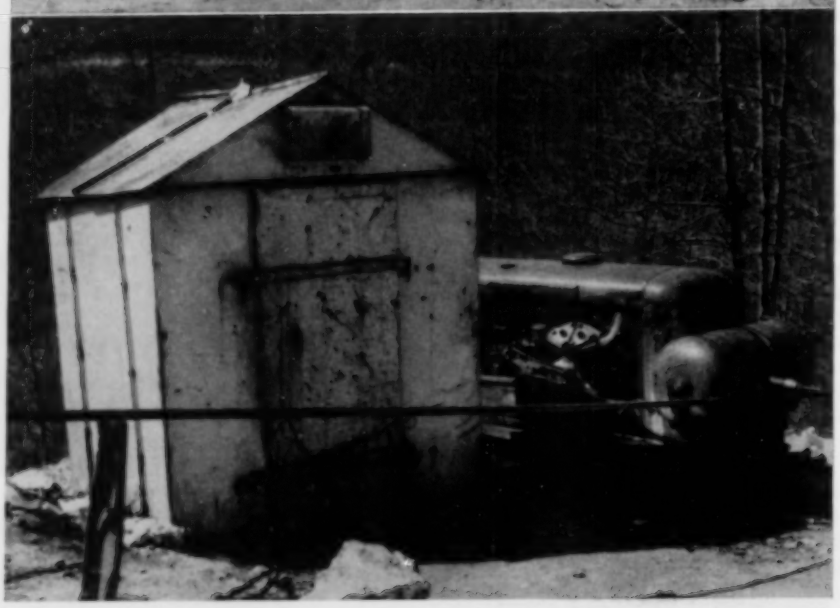
Vermiculite, a variety of mica, is among the less important minerals of the Spruce Pine area. Around 1930, interests of General Motors Corporation acquired deposits, but the depression prevented them from getting into production. Since 1949, American Vermiculite Company has been operating in the district. When heated moderately, granules of the mineral expand greatly and form a lightweight material suitable as an aggregate for concrete and wall plaster. Because it contains myriads of tiny air pockets, vermiculite is a good insulant against temperature changes, and as such is being put to a novel use in Canada. There the Dominion Iron & Steel Company is packing hot ingots of steel in the mineral for shipment from its open-hearth plant at Sydney, N.S., to another plant at Trenton, 200 miles away. The picture shows a 65-ton mass of metal being lifted out of its bed of vermiculite. After twenty hours in transit its temperature was 1600°F.



KONA FELDSPAR PLANT

Reputed to be the largest establishment of its kind, this plant of the Carolina Mineral Company produces feldspar by both dry grinding and flotation milling.





SMALL FELDSPAR MINE

A typical small-scale potash feldspar operation using a single drill supplied with air by an Ingersoll-Rand 105-cfm portable compressor (bottom). A simple timber derrick, center, is set up over the shallow vertical opening seen at the left to raise pans of material shoveled by hand.

are drilled from the one position. They are all in the same vertical plane and vary only as to elevation. The bottom one is flat or inclined slightly downward, and each succeeding one is pointed a little higher, the over-all result being a fan-shaped pattern.

The angles between adjacent holes are such that they terminate at points about 6 feet apart; their depth varies so that all will end in approximately the same vertical plane. The longest hole is the topmost one, which is put in with a 46-foot steel. After a series of holes has been drilled, the rig is moved over 6 feet and another identical set is put in. Drill rods are 1½-inch hollow round steel. Carset (tungsten-carbide-insert) bits of 2½-inch gauge are used and are good for an average of 350 feet of hole before requiring resharpening. This represents approximately one complete series of holes from one setup, and it also happens to be an average day's drilling.

Around 180 holes, comprising 20 sets, are normally blasted together. Up to about 40 pounds of Du Pont special gelatin dynamite of 60 percent strength is loaded in each hole and fired with millisecond blasting caps providing eight delays. This gives good fragmentation of the material, which is crisscrossed with fissures that persist even with depth. The few resulting oversize pieces are broken either with a drop ball or by secondary drilling with a Jackhamer. Loading is done with a Bucyrus-Erie ¾-cubic-yard power shovel, and Ford 5-ton dump trucks haul the rock to the flotation plant 2 miles away and several hundred feet lower. Enough material—from 600 to 700 tons—is produced in eight hours to keep the mill running 24. All the blast holes necessary to provide that quantity are drilled with one machine, though a spare wagon drill is kept on hand ready for service.

A development of importance to the district in 1952 was the purchase of Consolidated Feldspar Corporation by International Minerals & Chemicals Corporation. Consolidated, organized in 1928 by merging several producers of feldspar, operated thirteen plants in the United States and one in Canada. Feldspar accounted for 80 percent of its business, which also included mica, aplite, lepidolite, flint and beryl.

The significance of International's entrance into the area cannot yet be estimated, although it may be of far-reaching consequences. It is known, for instance, that the concern has recently put into operation in New Mexico a new method of recovering potash from its ore, and there is talk that the technique may be applicable to the beneficiation of the Spruce Pine minerals. If that proves to be the case, local milling practices may be revolutionized before many years have passed.

Also in 1952, the local plant of United Feldspar & Minerals Corporation was destroyed by fire. The firm, which has mills in other sections, decided not to rebuild. But the adverse effect on the community was of short duration because other establishments in the district were able to absorb all the crude material offered for processing and took over most of United's local feldspar sales business.

(Conclusion)

Compact Portable Compressor Aids Utilities

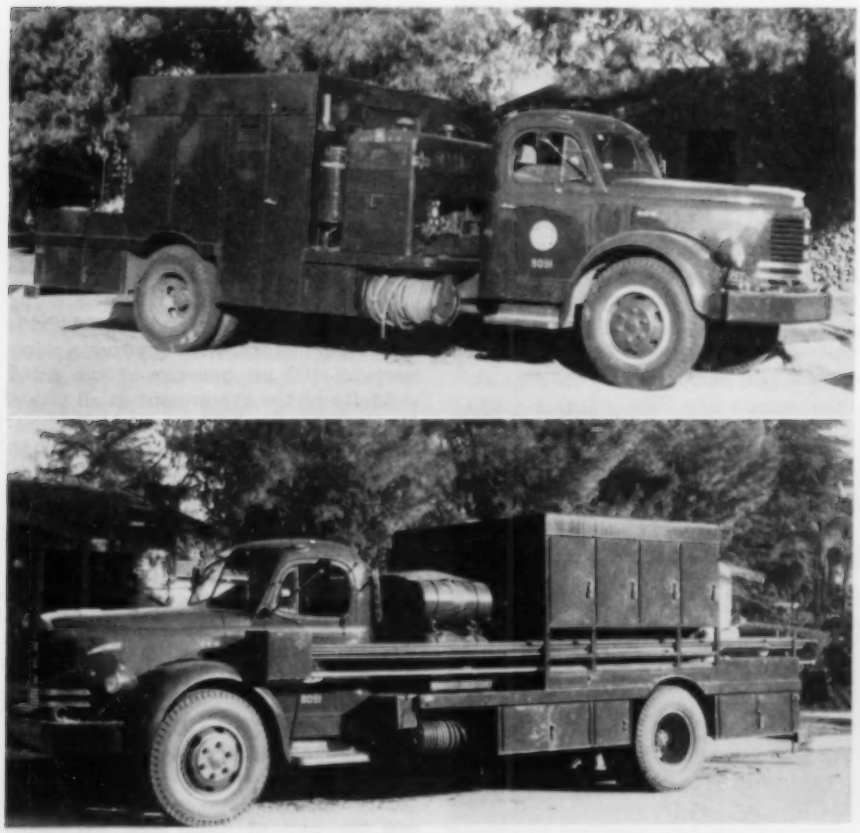
Gyro-Flo 105 Model Can Be Placed Crosswise of Truck with Room to Spare

ON LIGHT TRUCK

A 105-cfm rotary compressor is shown here mounted on a lighter truck than was ever used for the older reciprocating type of machine. Cross mounting of the compressor leaves ample room for tool boxes, hose reels, etc. The forward box contains paving breakers, clay spades and a Jackhamer drill and the low one at the rear holds moil points, Jackrods, detachable drill bits, etc. This vehicle is used by a Philadelphia utility.

LIKE other industries that engage in construction and maintenance work, public utilities have made many changes in the methods and equipment they employ for installing, servicing and maintaining their hundreds of miles of underground lines. All of them have had the general object of conserving hand labor and been prompted by the sharp rise in wages.

Portable compressors and various types of air-powered tools have long been standard equipment of line crews of gas and electric utilities, and because the work they must do is spread out over a lot of territory the aim has always been to make these outfits as mobile as possible. This has created a rather difficult problem, because the compressors available until recently were too bulky to mount crosswise of truck bodies without exceeding legal or safe limits for highway travel. With a machine placed lengthwise, room for carrying other equipment was considerably restricted.



ON 2½-TON TRUCK

Views of two sides of one of 60 service trucks used by a Pacific Coast gas company. The compressor occupies only a small part of the truck body, and in the lower picture it will be noticed that the machine is short enough to permit carrying pipes on the side.

Fortunately, the problem has been solved by the new rotary-type compressor called the Gyro-Flo which was introduced by Ingersoll-Rand Company two years ago. Changes in design embodied in this unit have permitted building the smallest and lightest self-contained portables yet devised. They are made in four sizes, with capacities of 105, 210, 315 and 600 cfm. Gas companies have long used 105-cfm portables mounted either on two pneumatic-tired wheels for towing or on skids for truck application.

The 105-cfm Gyro-Flo on skids weighs only 65 percent as much (2000 pounds with fuel, lubricating oil and cooling water) as the corresponding Ingersoll-Rand reciprocating compressor it replaced and needs only 49 percent as much space. Most important to utilities is its over-all length of 85 inches, which permits placing it crosswise of a truck just back of the cab and well within the vehicle-width limitations of most, if not all, states. As built for that purpose, the complete and self-contained unit is only 31 inches wide and 46½ inches high and occupies not more than 70 cubic feet of space.

Utilities are using these compressors on several types of vehicles. A Gyro-Flo installed on a light truck makes a highly mobile and relatively inexpensive outfit that arouses a minimum of objection in exclusive residential districts. Or the machine may be made an integral part of a

TRAVELING WORKSHOP

These views show how a St. Louis gas utility builds up commodious workshops on trucks. Although the compressor is well enclosed, it is mounted so that it can be readily removed for maintenance if required or for use elsewhere in case the truck is tied up for repairs. Note the convenient location of the operator's instrument panel just under the receiver-separator. Similar trucks are used by a large New Jersey utility.

traveling workshop for construction and heavy maintenance. In that case, its compactness and lightness make possible corresponding increases in space and carrying capacity for tools and personnel. Thirdly, a skid-mounted unit may be placed crosswise of a platform-body truck to make an extra outfit whenever one is needed. Some of the larger companies find it convenient to have two or three such compressors available at a central depot for quick loading if one or more are wanted on short notice anywhere along the system.

The Gyro-Flo, which was described in detail in these pages when it was introduced to the trade, is a rotary, sliding-vane, 2-stage, oil-cooled unit featuring floating-speed engine control combined with variable intake unloading of the compressor to eliminate "all-on, all-off" or even "stepped" regulation. Reinforced-plastic vanes in the slots of a rotor eccentrically mounted in both the low-pressure and high-pressure compressor cylinders are held against the cylinder walls by centrifugal force and compress air as they rotate. Compression is from 0 to 28 psi in the first stage and from 28 to 100 psi in the second stage.

Oil introduced into the air in the cylinders during compression serves to lubricate moving parts, to cool the air, and to seal the vanes against slippage. After compression, both the air and the entrained oil are passed through a highly efficient separator in the air receiver and, consequently, the air as discharged for use is for all practical purposes entirely free of oil and never exceeds a temperature of 200°F. The Gyro-Flo's "Air-Glide" regulation results not only in high fuel economy and low engine wear but also in much quieter and less disturbing operation than that of machines of older design.

The control range of the regulating system is between 100 and 110 psi and is set at the factory, thus assuring a minimum of 100 psi pressure at the rated capacity of the compressor at all times. Compared with I-R's previous reciprocating-type unit, the rotary has 155 fewer parts, 93 of which were subject to wear and replacement. This represents a decrease of 57 percent. Among those eliminated are valves, rods, pistons, rings, etc., which were frequently the cause of operating difficulties. Obviously, then, the decrease in the number of wearing parts appreciably reduces the amount of mechanical maintenance required.

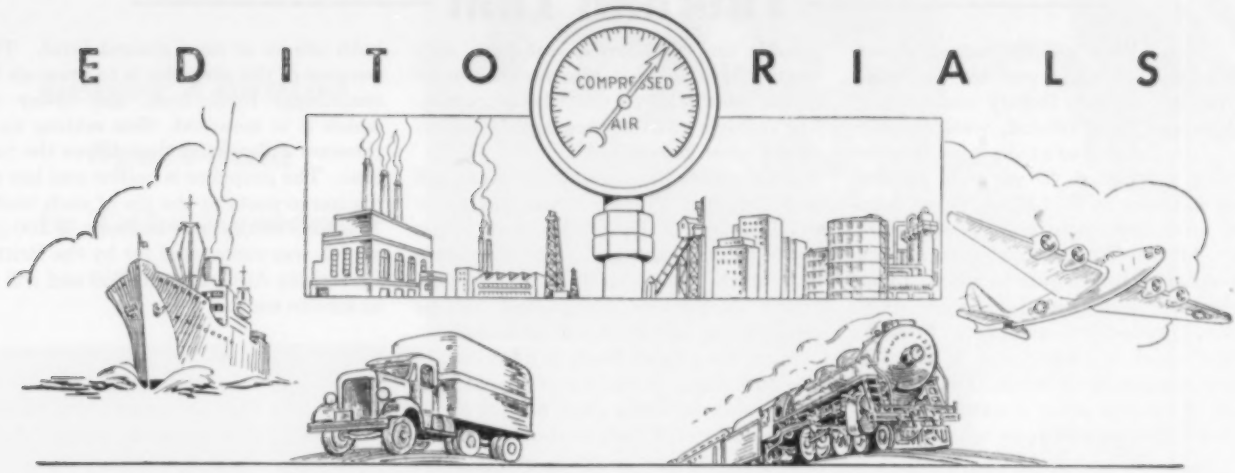
Acceptance of the Gyro-Flo 105 for cross-mounting has been rather general in the utility field. Accompanying illustrations show how several companies use the unit to meet their individual service-truck requirements.

ON PLATFORM TRUCK

Here a skid-mounted compressor was placed on an open truck for temporary service on Long Island, N.Y. Later it was transferred to a van-type truck. The machine is regulated to discharge at a pressure between 100 and 110 psi, which enables it to operate two paving breakers, as illustrated.

Adapted from a paper on "Development of 105-cfm Portable Compressors for Utility Service" prepared by J. E. Elliott of Ingersoll-Rand Company, New York, for the Builders Committee of the American Gas Association.

EDITORIALS



PRESERVING NIAGARA

NIAGARA Falls is to undergo surgery with the object of better distributing the now uneven flow of water over the awe-inspiring 160-foot international precipice. The face-lifting has been occasioned by the 1950 treaty under which the governments of the United States and Canada agree to take additional water from the Niagara River above the cataracts for power generation.

Actually, Niagara will be operated on a sort of shift basis. As one writer put it, they'll soon be able to turn the falls on and off like a spigot. With due regard for the feelings of nature enthusiasts and the undiminishing legions of honeymooners that visit the scenic spot, the cataracts will be at full strength between eight in the morning and ten at night during the tourist season from April 1 to October 31. At night the flow will be cut in half, and during the winter the reduced flow will be in effect 24 hours a day. Fortunately, the need for power is greatest in this season.

Man has been tampering with the Niagara ever since hydraulic generation of electricity was conceived. Fed by the discharge of four Great Lakes and the runoff from 255,000 square miles of land, the river normally carries around 215,000 cubic feet, or 1,600,000 gallons, of water per second. However, six powerhouses are now withdrawing water from above the falls, and the Canadians are putting in another huge station that will go into partial operation by 1957. A plant of equal capacity will be erected on our side of the stream as soon as we can make up our minds who is to run it. So far five private power companies have their bids in, and both New York State and the Federal Government also are interested.

About 87,000 cubic feet of water per second is now being siphoned off for power purposes, leaving roughly 128,000 cubic feet to tumble over the cliffs and make scenery. The 1950 treaty makers agreed that at least 100,000 cubic feet must pass over the falls during the daylight hours of the tourist season, but thought 50,000 cubic feet would suffice at night provided it is properly distributed. That's where face-lifting comes in.

A ridge in the streambed above the cataracts now diverts about 95 percent of the flow to the Horseshoe Falls on the Canadian side. To bring about a more equitable distribution, it is proposed to extend a deflecting structure 1550 feet out from the Canadian shore upstream from Goat Island, which divides the American and Canadian sections of the falls. It will be parallel to and 225 feet downstream from a shorter (900-foot) submerged weir put in by the Canadian Niagara Power Company, Ltd., in 1939 to increase the depth of water at the intake for its generating station.

Auxiliary construction planned includes either excavating or filling in at certain cascade areas on the Canadian and Goat Island flanks of the cataracts. The program has been agreed on by a Joint American-Canadian Commission. The cost, estimated at $17,536,000, is to be borne equally by the two countries.

Reduction of the river flow will most likely curtail the tendency of Niagara Falls to destroy itself. Since first seen by a white man, Father Louis Hennepin, in 1678, it has receded about 900 feet upstream and geologists estimate that it has retreated the full 7-mile length of the downstream gorge in the past 35,000 years. From 1842 to 1927 the rate of recession averaged 3.7 feet per year, but since the power plants began taking out water it has slowed down to 2.3 feet.

Erosion is greater on the Canadian side because there's more water there. Equalizing the flow over the 2600-foot Canadian falls and the 1000-foot American section would, it is believed, eventually straighten out the crest line and retard erosion. The main consideration, however, is to preserve the majesty and beauty of the falls, and the agreement between the two nations concerned provides for the setting up of a control board to keep tabs on the flow and make sure that honeymooners and nature lovers do not get shortchanged.

COBALT CELEBRATES

THE old-timers are gathering in Cobalt, Ont., this month to have a big celebration. They are commemorating the fiftieth anniversary of this picturesque camp that ushered in modern mining in Canada. For, as has been related in these pages before, much of the money made at Cobalt and many of the mining men trained there moved on to other fields and discovered and developed most of the worth-while mineral districts that have come into existence in the meantime.

Cobalt had a storybook beginning, regardless of which version of its origin you accept. At that time the Timiskaming & Northern Railway was being built into the section. According to one tale, two workmen, McKinley and Darragh, noticed some mineral adhering to a tree they had felled and snaked out of the woods to cut up into ties. The other narrative, a bit more spectacular, recounts that a piece of steel cast at a passing fox by Fred LaRose, a blacksmith, chipped a piece of ore from an outcropping vein. At this late date there is no way of determining which of the claimants was first, but it is a matter of record that LaRose filed proof of discovery on September 29, 1903, and McKinley and Darragh did so just one week later.

After a long period of prosperity, Cobalt declined, but only temporarily. The atomic age has reawakened it, for the metal cobalt, looked upon largely as a contaminant of the wanted silver ore in the early days, is now in great demand. As a result, the camp is getting its second wind, so to speak. For reasons unknown to us, the anniversary program will be at its height from July 5 to 11. It will include an old-fashioned hand-drilling contest, and a mining and mineral museum—scheduled to be a permanent fixture—will be stocked with old pictures, mining equipment and other reminders of the pioneer days of this Canadian cradle of mineral development.

This and That

Big Day for the Joneses

Four people named Jones, all employed by the same British factory and none of them related, were recently honored at the same time for having completed 40 years of service. The company is W. Martin Winn, Limited, and manufactures nuts and bolts. Mrs. Martin Winn, senior director, presented appropriate gifts to J.E.A. Jones, a director and general manager; H.E. Jones, production manager; Mrs. L. Jones, chief inspector; and Miss M.E. Jones, a machine operator. To cap it all, Mrs. Winn was given a watch in recognition of her own 40 years with the firm.

* * *

Servicing Racing Autos

Bill Vukovich, this year's winner of the annual 500-mile Memorial Day automobile race at the Indianapolis Motor Speedway, made three stops at the service pits but was motionless for only 2 minutes and 43 seconds over-all. During each halt his gasoline tank was filled, and in at least one instance all four tires were changed. This gives an idea of the speed with which racing cars are put back on the track by the skilled mechanics who minister to their needs.

Each driver has from six to eight attendants in his pit, but no more than four are permitted to work on the car at a time. The pit is in reality just a rectangular area alongside the track and separated from it by a concrete wall 28 inches high. The mechanics practice their tasks beforehand to eliminate all lost motion, because a delay of even a few seconds may ruin their man's chances of winning.

Actually, that is what some observers think happened to Vukovich in the 1952 race. With the running two-thirds over, he had a lead of nearly 4 miles over second-place Troy Ruttman, amounting in time to 1 minute and 48 seconds. Each car had to refuel once more, barring other contingencies. Vukovich stopped first. In 65 seconds his crew had filled the gasoline tank and put on four new wheels. But as he was about to start again he noticed that one rear wheel was on the axle backwards. He pointed to it and two men sprang to correct the mistake. A bit confused, they took a full minute to make the change. The racer was off the track for a little more than two minutes and Ruttman had meanwhile forged ahead.

Sensing victory, Ruttman increased his speed. When he came to a halt, his men had him going again in 55 seconds. During that interval Vukovich regained the lead, but only by a small margin. Obliged to increase his pace to stay ahead, his car developed mechanical trouble and was forced out with only twenty laps to go. Many experienced racing men believed that the extra minute Vukovich was idle because of the pitman's error proved fatal.

This year the pit work went off smoothly and Vukovich was the leader in all but two of the 200 laps (at $150 per lap in prize money). His first stop, during which four wheels were changed, lasted 49 seconds, the second one 64 seconds and the third one 50 seconds.

How the pitmen work is described in the June issue of the *Ford Times*. Special equipment helps them save time. A single downward push on the long handle of a jack elevates a wheel, and it is released by two or three hammer blows on a single retaining wing nut. One blow tightens the nut on the replacement wheel. A wheel has been changed in 7½ seconds.

The gasoline storage tank is under pressure of nitrogen gas, and when the valve is opened 40 gallons of fuel is transferred to the racer in less time than a filling station pump puts 5 gallons in the tank of your car. Changing or adding to the oil supply during a race is prohibited. This makes sure that precautions will be taken to prevent oil leakage and thus keep the track from becoming hazardous to travel. Before this rule was invoked, spilled oil was a source of trouble and caused several bad accidents.

Tires run hot under the high speed of the race. This year the air temperature was above 90°F and the track temperature 130°. Nitrogen is used instead of compressed air to inflate the tires because its pressure varies less under changes in temperature.

* * *

Britain's Coal Savers

The development of hydroelectric facilities in the north of Scotland promises to benefit Great Britain financially by making available for export sizable quantities of coal that have heretofore been required at home to produce energy in thermal plants. Last year the hydro stations saved 600,000 tons of coal, or about three-quarters of the total exported from Scotland. It had a value of approximately $7 million. When the construction program is completed, the amount of power generated will be about four times the 1952 figure.

Britain is also endeavoring to save coal by putting the wind to work producing electricity. The newest type of machine looks like a modernized windmill with a single propeller instead of many sails, but it doesn't function like one. Instead, it operates on the so-called depression principle. The generator is directly coupled to an air turbine, and both are at or near ground level. The purpose of the propeller is to draw air by centrifugal force from the tower on which it is mounted, thus setting up a pressure differential that drives the turbine. The propeller is hollow and has air discharge ports at the tip of each blade. The first of the new stations, a 100-kw model, was contracted for by the British Electricity Authority in 1949 and will be in service soon.

* * *

Rubber Roads Near

Rubber roads, long in the experimental stage, have come a step nearer realization with the formation of a company that will make and sell rubber in suitable powder form for mixing with asphaltic materials. Called Rubarite, the product is a finely divided unvulcanized synthetic rubber developed jointly by Goodyear Tire & Rubber Company, Berry Asphalt Company and the Baroid Division of National Lead Company. Tests on heavily traveled roads indicate that the addition of rubber lessens damage to the surface caused by both heat and frost and prolongs service life under the pounding of modern traffic. The problem of compounding a material that would be free-flowing was solved by combining it with barytes, the mineral base of oil-well drilling "mud." Rubarite can be used in either hot or cold asphaltic mixes. It will be produced at Magnet Cove, Ark.

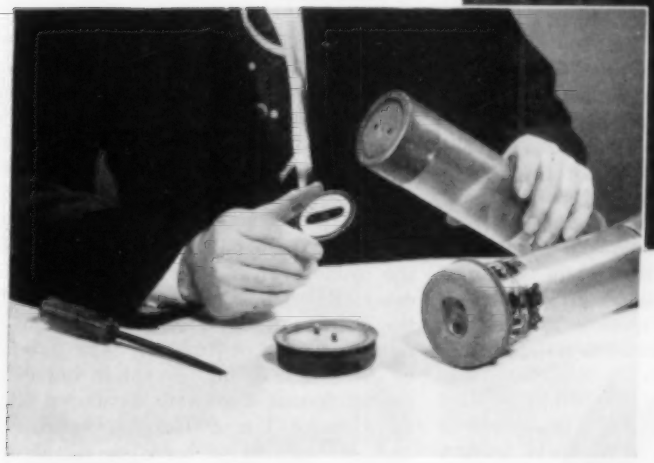
* * *

Air on the Farm

Farm mechanization continues to grow. The June *Country Gentleman* shows pictures of seven devices that are designed to speed the handling of hay and to lighten the human labor involved. Included is a suction system that unloads chopped hay from a wagon and delivers it where wanted in a mow at the rate of 18 tons an hour. Motive air for the purpose is provided by a blower operated by power take-off from the engine of a 2-plow tractor.

Another article discusses the subject of conditioning grain for storage by drying and cooling. Streams of air, either heated or unheated, are used for drying, and a suction device effects cooling. The latter consists of an L-shaped pipe with an electric fan at the elbow. The intake leg of the pipe, about 9 feet long, is thrust into the grain vertically, and the other leg, which carries off the exhaust, is in a horizontal plane. The lower 6 feet of the embedded section is pierced by hundreds of tiny slits. When the fan is put in operation it draws from 50 to 100 cfm of air through the grain and discharges it outside.

Geiger Counter Spots Jam in Tube System



KEEPS MESSAGES MOVING

Armed with a Geiger counter, as shown above, the trouble shooter can quickly find the spot where a carrier is jamming the pneumatic tube system. The tracer disk is hermetically sealed by heat and pressure between two plastic disks and fits in one end of the carrier (left). The cap lying on the table holds it in place and forms an airtight closure.

TROUBLE shooting with a Geiger counter is an easy job from the experience of The Carborundum Company, which is using a detector of this type to find specially equipped carriers that become jammed in a pneumatic tube system which interconnects its 40-acre plant and executive offices at Niagara Falls, N.Y. The lines have a combined length of 8000 feet and handle daily from 1500 to 2000 messages between sixteen departments. They are run through tunnels for accessibility.

Interruption in service formerly started men scurrying into the underground passageways to restore it as quickly as possible because the system's principal function is to dispatch orders in various stages of processing. It has been known to take hours and, on occasions, even days to locate a jam by the old procedure, which consisted in poking metal "snakes" through the piping. Now only one man is required to do the work, and as he walks along he holds his Geiger counter against the exposed walls of the tubes.

Enclosed in one end of each of the 200 mail carriers used is a tracer consisting of an absorbent paper disk that has been immersed in a solution of radioactive cobalt and water and sealed airtight between two pieces of plastic. When the Geiger counter nears the radioactive substance, what is known as the "background count" is increased and the trouble shooter knows that he has found the stoppage. (The instrument always records a number of pulses or clicks in a given interval on a dial or by means of earphones because minute quantities of radioactive materials are present in nearly everything on earth.) Service delays are therefore of but short duration. We are told that an infinitesimal quantity of cobalt—a drop worth 60 cents—is performing this important function and that it is no more dangerous to health than the luminous dial of a wristwatch.

Manganese from Waste Slag

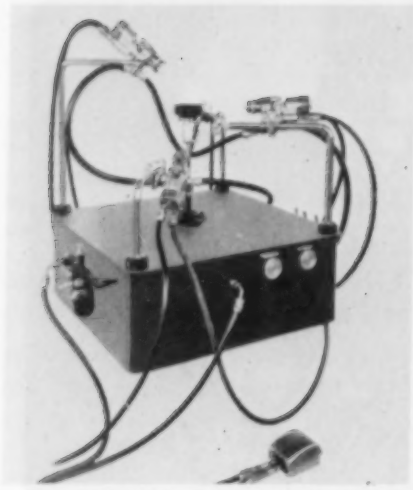
SOMETIME in August, a pilot plant being constructed by Mangaslag, Inc., near Pittston, Pa., under a contract with the Defense Materials Procurement Agency, is scheduled to begin the recovery of manganese from waste open-hearth slag. The process to be used has been developed under the direction of P.H. Royster, assistant to the chief metallurgist of the U.S. Bureau of Mines and, if found practicable, the company plans to build plants on a commercial scale to treat some 8,000,000 tons of the material contained in huge dumps that have accumulated at our steel plants.

About 500 tons of slag will be handled daily and produce spiegeleisen with 17 to 21 percent manganese and 3.5 to 4.5 percent phosphorus. The excess phosphorus will be removed by selective oxidation in a basic-lined Bessemer converter, during which 90 to 95 percent of the manganese is transformed into a synthetic manganese ore containing less than 1/10 of 1 percent phosphorus, less than 5 percent iron and from 55 to 60 percent manganese. When remelted in a furnace, the product will yield 80 percent ferromanganese with a phosphorus content below 0.35 percent. It is estimated that 400,000-500,000 tons can be obtained annually, or half of the steel industry's requirement when the present expansion program is completed.

OUT SHE COMES!

Here's something for those who like boating that is said to make it easy to beach small craft weighing up to 1200-odd pounds. Designed by The Airoller Company, the pneumatic cylinders are made of heavy rubber-lined dark-blue canvas and are inflated by lung power. They are used singly or in groups of two or three, depending upon the size of the boat, permitting it to be pulled ashore without effort and without scraping the paint off the bottom or damaging it if the beach is rocky. Called Airollers, they can also be used as life preservers, fenders or buoyancy tanks.

Industrial Notes



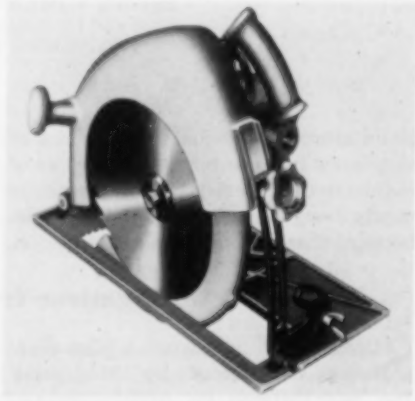
For plants with short-run spray-painting jobs that do not warrant investing in conveyorized systems, Conforming Matrix Corporation is building what it calls a "portable package" which can be used in most standard spray exhaust booths. It is a single-spindle machine that is equipped to mount four guns at different levels. They can be operated individually or in combination, depending on the work. The centrally disposed workholder is designed to serve also as a masking device when necessary. The spindle and air guns go into action at the touch of a foot valve and stop automatically as predetermined by a dial setting. There is another dial to regulate the spindle speed, which ranges anywhere from 100 to 400 rpm.

Beryllium-copper-alloy strip, precision-rolled to close tolerances and to thin gauge and foil is now being manufactured on a commercial scale by the Industrial Division of American Silver Company, Inc. The material is available in strips up to 8 inches wide with a minimum thickness of 0.0005 inch either solution annealed or rolled to temper in any quantity from one pound to thousands.

For use in small jigs and fixtures where space limitation is a factor, Air-Mite has designed an air cylinder with a 1-inch stroke that is said to deliver a thrust of 75 pounds on an air-line pressure of 100 psi. Called Micro-Model, the cylinder is machined from solid brass bar stock and suitable for both injecting and ejecting work and for clamping parts for processing or assembling operations such as drilling, riveting or welding.

The familiar No. 64 Mauser vernier caliper for inside, outside and depth measurements has been superseded by an improved model—the No. 101—which retains the important features of the old instrument. The new one, however, is made of rust- and tarnish-resistant chrome steel and has a vernier scale twice as long as before to increase the space between lines for easier reading. The spring gib is of hardened phosphor bronze, self-lubricating for smooth sliding action, and has two adjusting screws to take up wear and insure squareness of the measuring jaws. The price of the caliper, a product of George Scherr Company, Inc., remains the same.

One of the newest products added to the Ingersoll-Rand Company line is an air-powered circular saw that comes packed in a metal case with storage room for extra blades and a handle for ease of carrying. The blade, which has a diameter of 12 inches, is driven through a simple spur gear by a Multi-Vane air motor which, being close to the center of the tool, balances the weight evenly between its two handles: one in the form of a knob and the other a grip handle in which the throttle lever is located for safety. When the latter is released, the



saw stops well-nigh instantaneously. The operator is fully protected against injury by a housing on top and a telescoping guard underneath the blade. These, together with the motor housing, base and handles, are of cast aluminum for lightness and durability. The tool is designed to use air at a pressure of 90 psi and is provided with a hand and a thumb screw to change the depth (maximum 4⅜ inches) and angle of cut (maximum 4 inches at 45°). Maximum thickness of material required for a 45° bevel cut is 2⅞ inches. A complete set of interchangeable blades for different work is available. Demonstration of the S-12 Air Saw, as it is designated, can be arranged through any Ingersoll-Rand branch office, which will also mail upon request Form 5124 containing detailed information about the tool.

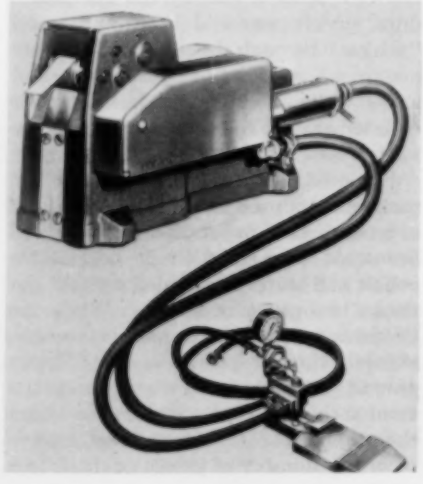
In addition to its 55-gallon Drum Warmer, Harold L. Palmer Company is now offering a size to fit standard 30-gallon containers carrying viscous fluids. Of the same cylindrical and hinged construction and operating on 220-240 volt single- or 3-phase a-c, its insulated electric elements melt the contents for removal. Unit includes a thermostat designed for temperatures up to 250°F.

By means of a detachable pressure edger wheel designed by Solaire Industries, contractors can run their rollers right up to walls or curbing and thus eliminate the work of finishing paving by hand labor.

Granite flats or plates that prevent seizure of gauge blocks or checking fixtures are being made by Collins Microflat Company. This is achieved by a method of lapping that is said to provide a continuous bearing surface interspersed with micronic air pockets.

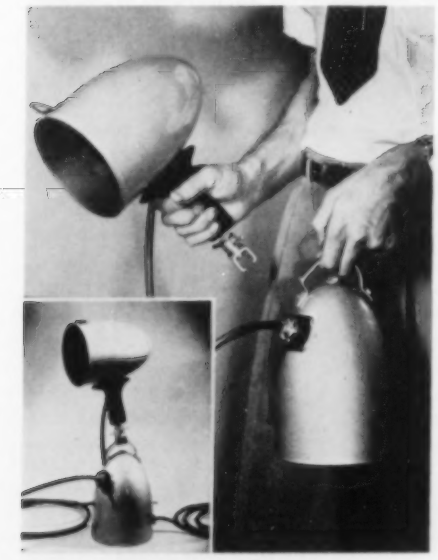
Windows can be washed safely from the inside even if they are not of the casement type. It is done every day in the Pittsburgh skyscraper of the Aluminum Company of America. The panes in the new building are set in hollow, rubber frames that were developed by the General Tire & Rubber Company and are inflated to hold the windows snug and draftfree. When the air is released, they can be swung around on a central pivot. The men that do the cleaning carry small air pumps to recharge the frames.

Pressure-sensitive tape is now so widely used in industry that Air Fixtures Incorporated has developed a pneumatic dispenser that is foot controlled to leave the worker's hands free to apply it in the manufacture of radio, television, and electrical components and appliances, in winding motors, for masking parts to be processed, for packaging, etc. Designed to handle tape of varying widths and types, the device is adjustable to feed it in predetermined lengths to prevent wastage. The Model AF-92 shown holds rolls up to 5½ inches in diameter and from ¼ to 1 inch wide and dispenses



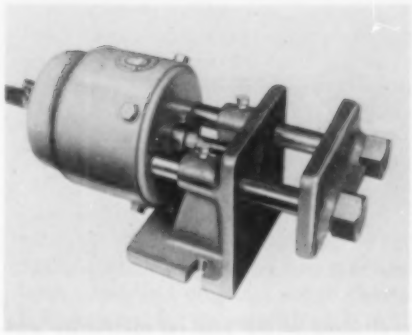
them in ½- to 6-inch lengths. The AF-85 takes 6½-inch rolls (maximum diameter) from ¼ to 2 inches wide and dispenses them in 1½- to 9-inch lengths. Both are provided with air regulators and gauges and are built for pressures ranging from 20 to 100 psi. For narrow, easy-to-pull tape, air at 30 to 40 psi is usually adequate, while wider, more resistant strips may require pressures from 50 to 60 psi.

Ultraviolet or black light is finding increasing application outside the laboratory and will, it is predicted, eventually be in greater demand for industrial than scientific purposes. With this in mind, Ultra-Violet Products, Inc., has designed a 100-watt portable inspection lamp that operates on 110-volt a-c and is said to throw a powerful beam of long-wave ultraviolet (3600 A.U.) for a distance of 30 feet. Called Mineralight, it consists of a transformer encased in a nontip base and of a bulb and filter safely re-



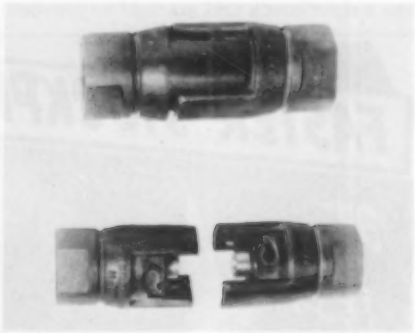
cessed in a hood provided with a handle that can, if desired, be securely clamped in any position to the base, where the switch is located. The B-50-H Model, says the manufacturer, will detect oil leaks in machinery or on fabrics because the slightest trace emits a bright glow under black-light activation; and, in combination with invisible fluorescent inks, dyes or powders, will detect flaws in metals, reveal adulterants, decay or contaminants in foods, and spot areas not properly covered with protective coatings. It's use by geologists and prospectors to locate tungsten-bearing and other minerals that fluoresce when exposed to ultraviolet rays is familiar to most everyone.

What is described as the simplest air-controlled vise ever built has been announced by The Wilson Bohannan Company which manufactures padlocks and developed the fixture for its own use. Designated as the RIK Vise, it is pro-



vided with a Bendix-Westinghouse Robotair chamber or cylinder which, together with the stationary jaw, is on the same side as the workpiece. This is a revolutionary arrangement and is said to result in greater speed of production and safety for the mill operator. With the moving jaw at the end of the assembly, the cutting tool need not pass over the cylinder and the worker does not have to place his hands close to the cutter when inserting and removing parts. The vise can be readily mounted on most machine tools such as vertical and horizontal milling machines, drill presses, boring mills and shapers and synchronized with their movements. At present it is available with either a Type 9 or a Type 12 Robotair chamber providing, respectively, a clamping force of approximately eight or eleven times the air-line pressure. The unit has an overall length of 12 inches, and jaws are 5½ inches high, 4½ inches wide, and have a standard opening of 2 inches.

Positive shutoff of compressed air when disconnecting hose from tools is the claim made by Twinmatic Corporation for its new 2-way coupling which obviates opening and closing valves at air receivers. Each half has a spring-seated valve which is sealed by the pressurized air bearing against the end, thus preventing passage of the air when the

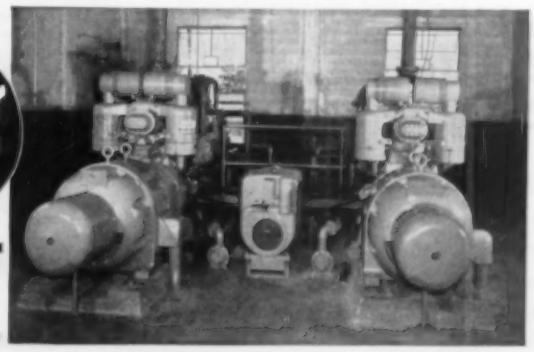


coupling is disconnected. When connected, the valves butt against each other, opening the seats and permitting the air to flow through freely. Under-

Power TO FIT THE JOB

Power TO FIT THE MACHINE

Starting Power Is Important...



provided by a WISCONSIN HEAVY-DUTY Air-Cooled ENGINE

Big diesels deliver standby power protection at this Florida refrigerated citrus warehouse . . . one of the largest in the South. But every bit as *vital* is the role of the 4-cylinder Wisconsin Heavy-Duty Air-Cooled Power Unit. *It starts the diesel, if electric power fails.*

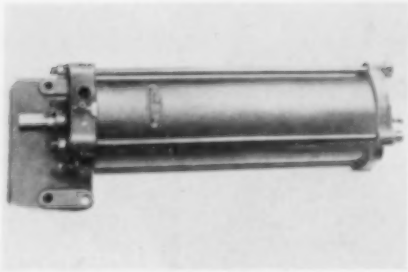
Wherever there's a 3 to 36 hp. assignment, you can look for and usually find a Wisconsin Engine delivering dependable power to fit the job and the machine. Wisconsin Engines offer *the widest margin of usable power.* These engines *deliver* and *hold* the horsepower shown on the horsepower curves. Heavy-duty construction and service features, plus easy, positive starting, fool-proof air-cooling and thrust-absorbing tapered roller bearings at both ends of the crankshaft *add up* to reliability *plus.*

Complete your data file with facts about full line of WISCONSIN 4-cycle single-cylinder, 2-cylinder and V-type 4-cylinder models, 3 to 36 hp.

WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

A 7420-½

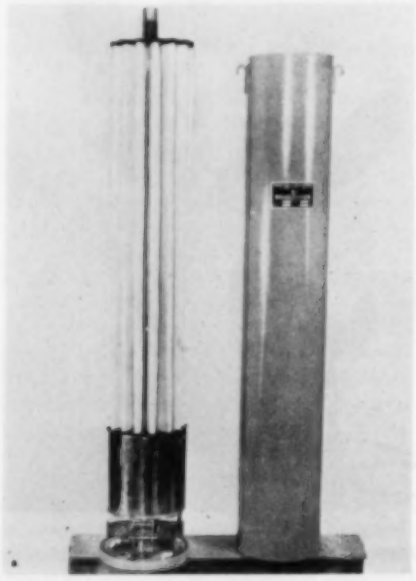
water tests at 125 psi reportedly indicated no leakage in the assembly. Units have anodized-aluminum bodies and brass valves and seats and are precision ground to insure perfect mating. They are said to make it possible to change pneumatic tools quickly and without the danger of accidents attributable to high-pressure air remaining in the hose when being disconnected.



A new line of pneumatic counterbalance cylinders for power presses and similar equipment has been announced by Dayton Rogers Manufacturing Company. The units serve as a brake much like a door check and are said to prevent overriding of the ram on midstroke and to absorb the percussion shock or blow when the punch section of the die breaks through the blank. This results not only in smoother action but also insures longer die life and reduces wear on the ram clutch mechanism. The cylinders are now available in sizes from 5 to 12 inches to meet most power-press needs.

Dirt, grease, paints, oils, carbon, tar and shellac—in fact, just about everything that soils workers' hands—are quickly removed, it is claimed, by use of a cleansing cream put on the market by Du Pont. The preparation becomes liquid on contact with the skin and dissolves grease and grime when rubbed in briskly. Water is not needed, and paper towels may be used to wipe the hands.

Greater than usual economy of operation is claimed by Hankison Corporation for its new Model A-100-D Condensifilter that serves to clean and dehydrate compressed air. This improvement is the result of a disposable filter cartridge of wire mesh and flannel that is said to provide more than 24 square feet of filtering area, an increase of 37 per-



cent over earlier types. When dirty, the entire cartridge is replaced by removing one nut. Under normal working conditions it is good for five to six months' operation. The condensing unit has more than 950 square inches of heat-exchange area and lowers the dew point of the air traveling through it to within 2 or 3 degrees of the temperature of the cooling water used. Accumulated condensate—moisture, oil and other contaminants—is discharged through a snap-action, spring-loaded trap designed to prevent leakage or pressure loss.

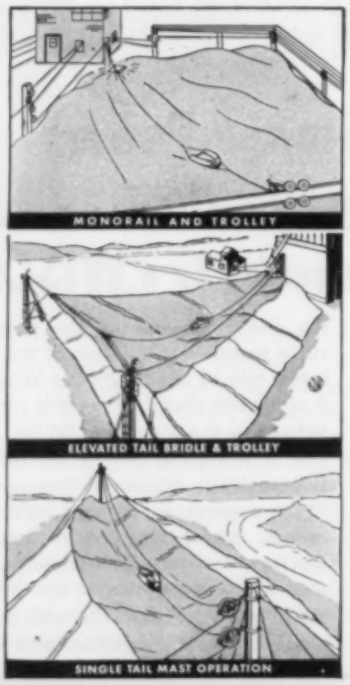
Air-powered and controlled by a hand or foot valve, the improved Bend-Ex machine recently announced by Paul Machine Tool & Die Works is said to work smoother and faster than earlier models. It handles round tubing, light angles, channels and solid bars and is provided with interchangeable dies and

FASTER STOCKPILING at less cost... with a SAUERMAN SCRAPER

(Above) Storage and rehandling of thousands of tons of phosphate rock at large processing plant is accomplished by two Sauerman Drag Scraper units of medium size. Machine in foreground has its hoist mounted on a flat car, while the machine on opposite side of track uses a high head tower.

Whether the storage area is small or large—indoors or outdoors—whether the material is light or heavy—there is a type and size of Sauerman Drag Scraper to solve the problem and cut handling costs to rock bottom. The Sauerman method is faster and more efficient because its operation is continuous and automatic—all under the finger-tip control of a single operator. The unique Crescent bottomless bucket quickly loads to capacity—slides smoothly over the top of the material being handled—completely empties as it's pulled backward.

Both initial cost and operating expense is moderate. The simple maintenance needs are economical. Diesel, gasoline or electric power consumption is small compared to tonnages handled.



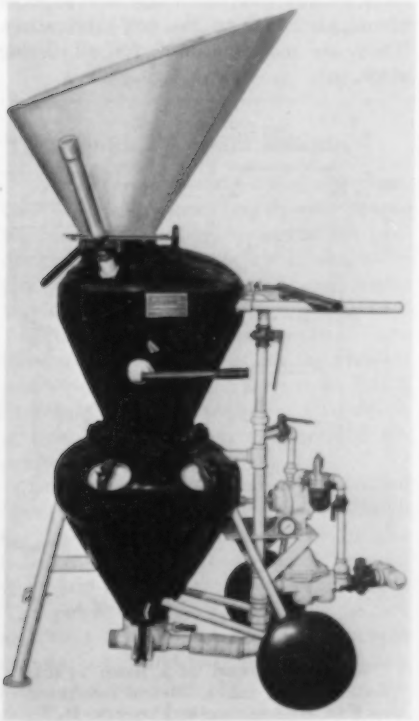
Above are three types of Sauerman Scraper Systems used to build larger stockpiles.

Write for free illustrated Catalog E, "Bulk Storage By Power Scraper".

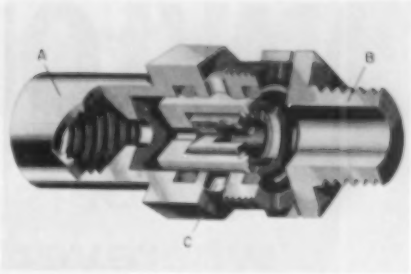
SAUERMAN BROS., INC.
548 S. Clinton St. Chicago 7, Illinois

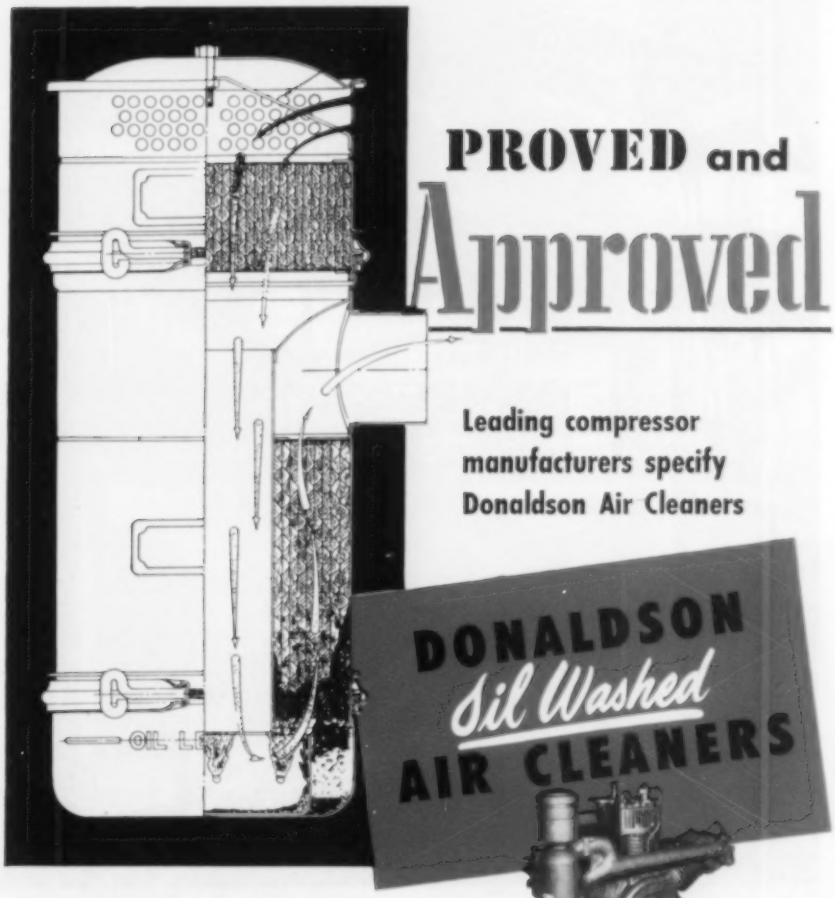
jaws of varying sizes to do a variety of bending jobs. No skill is required to operate the unit, the stock is simply slid over a mandrel to a preadjusted stop, gripped by an automatic clamp and bent by admitting air at 80 psi to a pneumatic cylinder. According to the company, ten bends can be made in a tube 10 feet long and ½ to 1¾ inches in diameter, or as many as 1000 per hour in 16-gauge, 1⅛-inch (outside diameter) steel tubing. Special models have been built up to 14 feet long.

Blastcrete Equipment Company, Inc., has announced a completely redesigned Blastcrete Gun, Model PM-1, suitable for placing all cementitious materials and refractories as well as many lightweight aggregates. Listed among the improvements that facilitate operations are a new loading-chamber slide valve that makes for faster loading, and two controls: one to regulate the air pressure, as required, and the other to adjust the flow of materials or cut off the supply when free air is desired or when it is necessary to blow out the lines. The equipment handles materials containing up to 6 percent moisture and places 1 to 5 cubic yards per hour, or 1¼ cubic yards, with 100 cfm of air. It meets the ASME Code for pressure vessels.



Shown in the accompanying cutaway view is a new type of quick-release air valve for pneumatic clutches up to 1500 hp that is guaranteed by the manufacturer, Deublin Company, not to chatter. It is designed for pressures from 0 to 250 psi, the air flowing in at "A," out at "B" to clutch and exhausting at "C." Features claimed for the unit are lightness (1½ ounces), permitting it to be used on rotating elements without disturbing the dynamic balance; a built-in orifice that prevents pressure equalization re-





Proved in the laboratory and in the field, Donaldson Air Cleaners meet all the rigid requirements of air compressor applications. Practically all dust, including elusive "extra fines" is removed to reduce wear on compressor parts; and the oil-trapping upper condensing element reduces oil loss from cyclical "blow back" to a minimum.

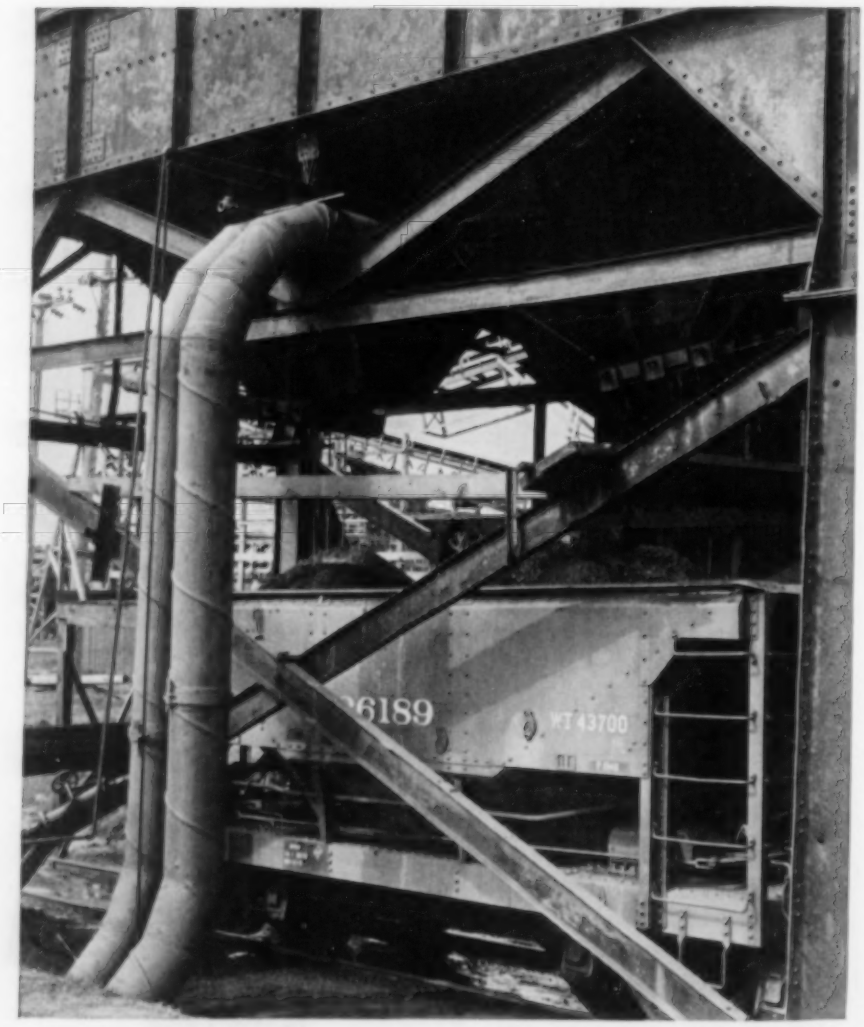
Donaldson air compressor Air Cleaners are used extensively by leading manufacturers on units with a wide range of capacities. Write for specifications.

DONALDSON CO., INC.
666 Pelham Blvd., St. Paul 4, Minn.
DONALDSON CO. (Canada) LTD., Chatham, Ontario
GRINNELL DIVISION: Grinnell, Iowa

Donaldson AIR CLEANERS

NAYLOR PIPE...

Gets around wherever you need it



You can always depend on this distinctive, extra-strong lightweight pipe to carry the load. That's why you see so much of it on the job in mining service—whether it's for tailings, water supply or high and low-pressure air. Bulletin No. 507 will give you the details.

NAYLOR PIPE COMPANY
1245 East 92nd Street, Chicago 19, Illinois
New York Office: 350 Madison Avenue, New York 17, New York

sponsible for chatter; and double-piston construction that insures smooth, positive, quick-release action.

For use with its Glo-Melt resistance-soldering unit, Wasserlein Mfg. Company, Inc., is offering an accessory called Pencil Handpiece that is 5 inches long, ⅜ inch in diameter and weighs only ½

ounce. It is available in two styles: Model A, which holds a ⅛-inch carbon tip, and Model B for a 3/16-inch tip. They are designed for instant conduction soldering by establishing a ground circuit through the company's standard grounding clip and lead or with the special mating plugs, sockets or fixtures found in modern plants. The device is suitable for fine work where sensitive and precise control is required, as in the case of components for radio, TV and electronic equipment.

Backup rings machined in spiral form of tetrafluoroethylene (Du Pont's Teflon) have been designed by The Garlock Packing Company to prevent extrusion of "0" rings. They are said to have a high impact strength at temperatures from minus 100 to plus 500°F; not to corrode, adhere and fray; to be inert to most chemicals; and to be self-lubricating. They are manufactured for all 0-ring sizes.

"As a kid I read of a man cracking an egg on a 20-ton hammer. I've always wanted to try it."

QUOTES

—FROM HERE AND THERE

Rubber Buildings Reared by Air in Minutes

"B.F. Goodrich has produced rubber-walled buildings for the Armed Forces. Deflated, an Air Force briefing tent of rubber-coated fabric can be packed in eight duffel bags. When the eight sections are joined—by 320 feet of zippers—and air is pumped into pockets which serve as girders, a building big enough to hold 100 men rises magically. Inflation takes only six minutes."

Reader's Digest, June, 1953

New Type Spray Gun for Vermiculite Paint

"Workers at the Puget Sound Naval Shipyard have a new outfit for spraying vermiculite antisweat paint. Previously, this shipyard used a hopper type outfit—in which the hopper was suspended overhead and the vermiculite was fed to the spray gun by gravity. This method proved unsatisfactory because the excessive amount of air required dried out the binder before the granular vermiculite hit it, and the hopper feed would often clog. About 100 sq ft per 8-hour shift could be covered.

"The new equipment consists of a spray gun that produces a suction which, in turn, draws the vermiculite into the air stream from the vermiculite container mounted below the gun. With this outfit, it becomes less difficult to reach spots that are not readily accessible, such as over ventilation runs, and in many cases the coverage can be raised from 100 sq ft to 600-800 sq ft per 8-hour shift."

Plant Engineering, May, 1953

Air Circuits Double Output

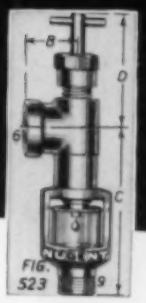
"With a compressed air line in a plant, the versatile engineer has a power source he can easily adapt to particular production needs. Air is abundant, relatively inexpensive, flexible and easily transmitted.

"The "homemade" air devices . . . are having a pronounced effect on production volume. One such device, at Barth Stamping and Machine Co., Cleveland, is now becoming quite generally accepted . . . .

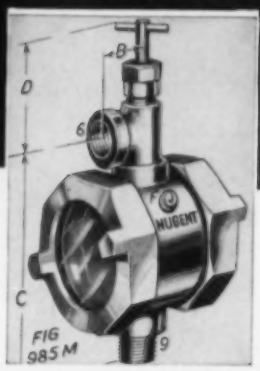
"A special fixture, with a spring-loaded ejector rod, had been designed by Barth for the job. But the reaming of the two holes involved quite a bit of manual work and one operator to each machine. The piece was loaded into the fixture and held by hand, while the operator manually fed and withdrew the reamer. Part ejection from the fixture was accomplished by tapping the ejector knob.

See...Don't Guess

Install NUGENT Sight Feed Valves for LUBRICATION CONTROL



13 models designed for working pressures to 125 psi. Sizes to ¾ inch.



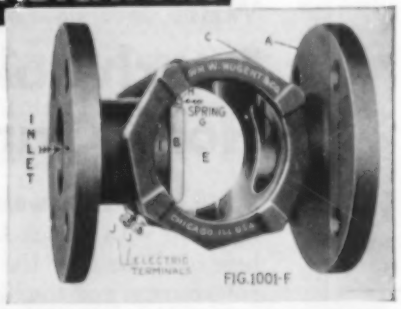
9 models for larger machinery. "Swivel and lock" type for sight chamber adjustment to most convenient view position.

Medium size needle type with steel valve stem. 9 models. Sizes to ¾ inch.

WITH a Nugent Sight Feed Valve in your oil line, you can tell at a glance whether or not vital parts are receiving proper lubrication. Nothing is left to chance and there's no guess work involved. Oil flow through the valve is controllable from 2 drops per min. to 21 gals. per hour depending upon oil viscosity and valve model. All are vented to prevent air binding. Glasses and screens are removable for cleaning without interrupting oil flow.

SIGHT FLOW INDICATORS

ANOTHER NUGENT instrument for solving lubrication problems is the Sight Flow Indicator. Installed in a machinery oil system, this device sounds an alarm when oil is not getting to bearings. When oil is not flowing properly, Indicator "B" (See Fig. 1001-F) closes making contact with terminals "J". This sounds the alarm making it possible to locate trouble quickly, protect valuable machinery and save on costly down time.



Sight Flow Indicator available with tapped or flanged connections. Removable windows. Can be installed right or left hand or vertically.

For trouble free lubrication systems, write for descriptive bulletin on the Nugent Sight Feed, Sight Flow Indicator and other Lubrication Specialties.

Wm. W. Nugent & Co., Inc.

441 N. Hermitage Ave. CHICAGO 22, ILLINOIS

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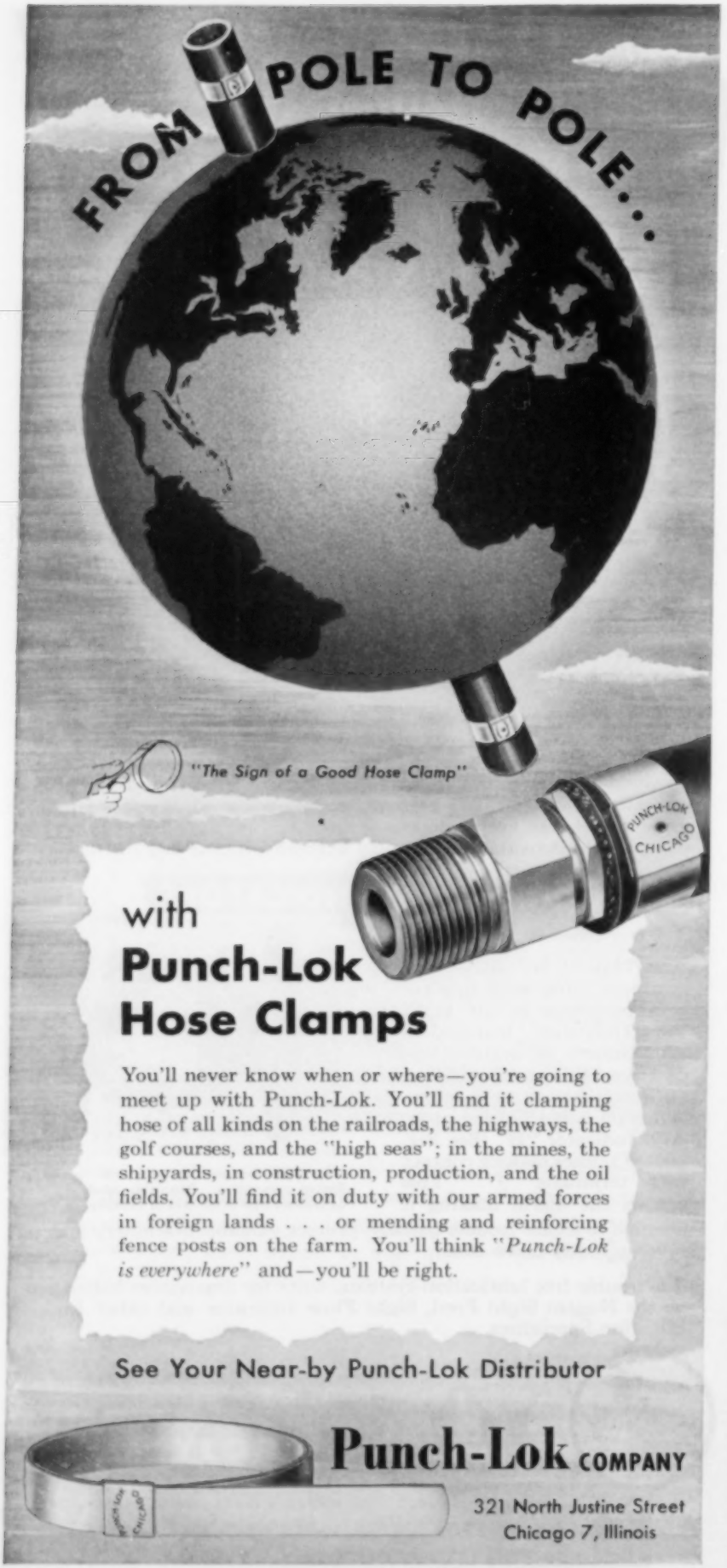
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You'll never know when or where—you're going to meet up with Punch-Lok. You'll find it clamping hose of all kinds on the railroads, the highways, the golf courses, and the "high seas"; in the mines, the shipyards, in construction, production, and the oil fields. You'll find it on duty with our armed forces in foreign lands . . . or mending and reinforcing fence posts on the farm. You'll think "Punch-Lok is everywhere" and—you'll be right.
See Your Near-by Punch-Lok Distributor
Punch-Lok COMPANY
321 North Justine Street
Chicago 7, Illinois

"A study of the operations revealed three motions which could be done quickly and reliably with air: holding the workpiece in the fixture, feeding the reamer and withdrawing the reamer.

"Further study showed that the air circuits for two machines could be easily linked to the main air line and that one operator, seated between the machines, could operate both . . . . This meant one operator on two machines and, at minimum, a 100 per cent production increase per operator."

From Plant Engineering

Substitute for Germanium?

"Scientists at Battelle Memorial Institute, Columbus, Ohio, report the development of a low-cost material that may compete with germanium and silicon for use in transistors, rectifiers, and other electronic devices.

"The potential competitor is a compound of aluminum and antimony. It is one of several that may come from compounds of aluminum, gallium, and indium with arsenic and antimony. Rectifiers have already been produced in the laboratory with the new 'semiconductor material' and its use in the making of transistors is a distinct possibility, according to Dr. A.E. Middleton, of Battelle Institute.

"Studies sponsored . . . by the Bradley Mining Co., San Francisco, Calif., have shown that aluminum-antimony has electrical properties 'at least as interesting as those of germanium and silicon.' Furthermore, the new semiconductor material may be superior to germanium, and perhaps silicon, for military uses where operation at high temperatures is required.

"Aluminum-antimony is likewise attractive, costwise . . . . Both components currently sell at less than 50 cents a pound. Germanium sells for about $350 a pound."

Mining Congress Journal, May, 1953

"That guy is nuts. He'll never get any worms pecking on a rock."

Books and Industrial Literature

The second edition of M.F. Spotts' *Design of Machine Elements* has appeared recently with many changes and an increase in size permitting a more detailed presentation of certain topics and the incorporation of new material. The chapter on working stresses has been expanded; those on bevel, worm and helical gears have been rewritten; new data on the design of shafting have been included, as well as on standard-size spring wire and rubber springs, on the Unified Thread and on partial journal bearings; and methods of determining the gears of a train of specified ratio are given. The book retains the original idea of instilling a professional viewpoint in the student and of preparing him for the conditions he will meet after leaving college. Many problems and answers in its pages will enable him to acquire a working knowledge of the theories propounded. Mr. Spotts is professor of mechanical engineering at The Technological Institute, Northwestern University. Publisher, Prentice-Hall, Inc., 70 Fifth Avenue, New York 11, N. Y. Price $9.65.

Bulletin No. 141 describing common applications of zinc dust can be obtained by writing to Federated Metals Division, American Smelting & Refining Company, 120 Broadway, New York 5, N.Y.

Upon request on company stationery, Dayton Rogers Manufacturing Company, Minneapolis 7, Minn., will send free of charge a decimal-equivalent chart and calendar from July, 1953, to July, 1954.

Tips on selecting the right starter for squirrel-cage induction motors rated up to 600 hp at 600 volts or less are contained in a new publication released by Allis-Chalmers Manufacturing Company, 1000 S. 70th Street, Milwaukee, Wis. Ask for Bulletin No. 14B7733 when writing for this guide.

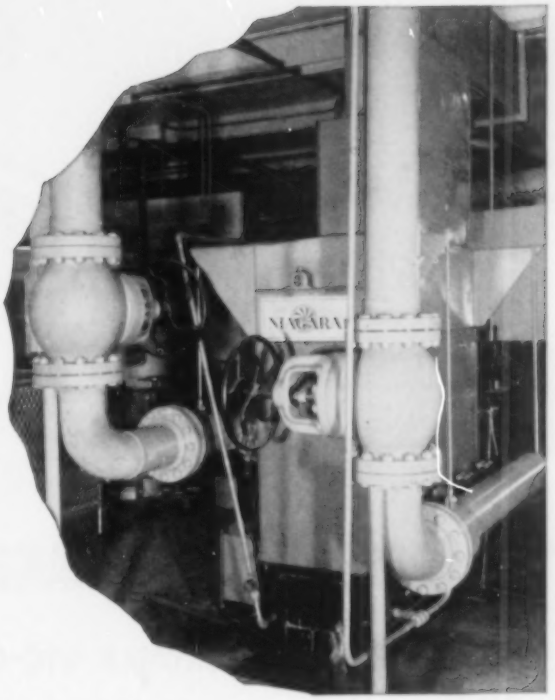
Industrial firms writing on company letterheads can obtain without cost Parker Safety Equipment Company's Catalogue No. 16 illustrating and describing all its protective equipment for the body, hands, feet, legs, heads, faces and eyes of most workers. Address requests to 785 Lyons Avenue, Irvington 11, N.Y.

The Erie Tool Works, Erie, Pa., has announced the availability of a price list and catalogue, No. 353, showing its complete line of tools for plumbers, steamfitters and machinists. Of twelve pages, it also discusses the company's new Unconditional Guarantee Policy for an unlimited period on all its products.

Sauerman Bros., Inc., 522 S. Clinton Street, Chicago 7, Ill., has announced a new catalogue containing full information about its line of hoists for operating power-scraper excavating and storage machines, slack-line cableway excavators and taut-line cableways. A profusely illustrated 24-page bulletin, it includes information on clutch and brake controls. General Catalogue, Section N, will be mailed free upon request.

Solving Roof Problems, a 32-page brochure issued by The Tremco Manufacturing Company, is based on data supplied by its laboratory and on the field experience of its 125 roofing representatives. For easy reference, it is divided into fifteen indexed sections dealing with every phase of the subject from how to build various types of roofs and factors entering into their deterioration to diagnosing and treating troubles. Copies

How to get drier or cooler air or gases . . .



NIAGARA AERO AFTER COOLER cools a compressed gas, or air, below the temperature of the surrounding atmosphere, thus preventing the condensation of moisture in your lines. The gas will contain only half of the moisture left in it by conventional methods. Even drier gas can be produced if you require it.

In working with controlled atmospheres of inert gases to prevent undesired reactions, this dryness of the gas at low cost is a great advantage. The cost of the Niagara method is low because it uses evaporative cooling, saving 95% of the cost of cooling water (and its piping and pumping). This direct saving of cost pays for the Niagara cooler in less than two years.

If you use compressed air to operate tools or pneumatic equipment you save much in water and oil damage to tools and equipment, and in water damage to materials by using the Niagara Aero After Cooler.

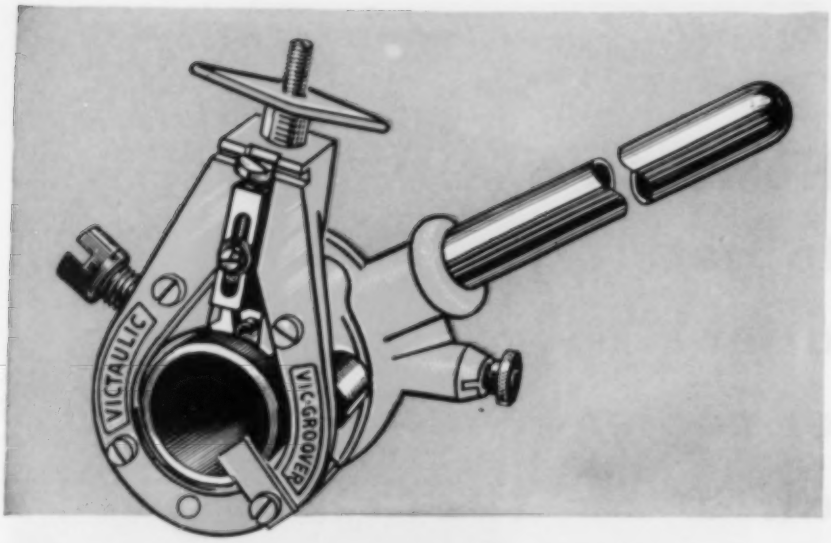
Write for a bulletin, or ask nearest Niagara Field Engineer if you have a problem involving the industrial use of air.

NIAGARA BLOWER COMPANY

Over 35 Years' Service in Industrial Air Engineering

Dept CA , 405 Lexington Ave. **New York 17, N. Y.**

Experienced Field Engineers in Principal Cities of U. S. and Canada



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may be obtained from Tremco representatives or direct from the company at 8701 Kinsman Road, Cleveland, Ohio.

Engineering Catalogue No. 700, recently announced by Victor Manufacturing & Gasket Company, P. O. Box 1333, Chicago 90, Ill., deals with its complete stock of "O" Rings for moving or nonmoving seals. They are made of the firm's Victoprene synthetic rubber for automotive, aviation and machinery industries. Copies are obtainable upon request.

Murchey Division, Sheffield Corporation, Dayton 1, Ohio, has issued a catalogue on such products as radial die heads, both rotating and nonrotating, tangent die heads, solid adjustable, machine and pipe taps, chasers, accessories and other special threading tools. Catalogue MU-153 can be obtained by writing request on a business letterhead.

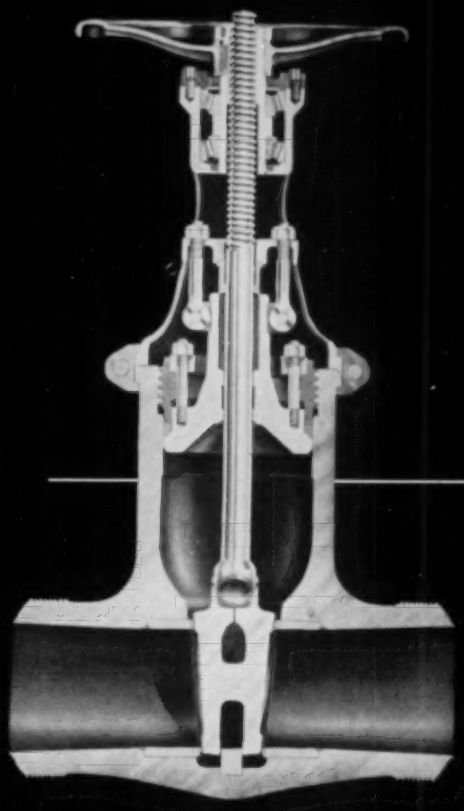
Separate marking of parts is eliminated by equipping screw machines, lathes and similar equipment with an automatic Roll Marker announced by New Method Steel Stamps, Inc., 147 Joseph Campau, Detroit 7, Mich. The device does its work during the machine cycle and is suitable for end-face and side imprinting. Drawings of the Model 600-E, together with mounting and operating instructions, are contained in a bulletin obtainable from the company.

The last issue of *Die Headlines*, published intermittently by The Eastern Machine Screw Corporation, 140 Truman Street, New Haven, Conn., deals with the importance of proper machine alignment when cutting screw threads and describes the newly developed H & G Alignment Indicator that makes it possible, it is claimed, to correct misalignment by accurately determining its extent and direction. Ask for No. 2, Vol. 4, when writing for a copy.

A 20-page booklet recently announced by Allegheny Ludlum Steel Corporation discusses its stainless-steel wire that is now available in nearly all the grades of metal made by the firm. It lists applications and includes tables giving analyses, physical properties and corrosion resistance to different media—information designed to help users choose types to meet their needs. Address the company's advertising department, 2020 Oliver Building, Pittsburgh 22, Pa., when asking for a copy.

Republic Manufacturing Company, 1930 W. 77th Street, Cleveland 2, Ohio, is distributing a new catalogue on its line of valves and specialty devices that lists two items—a gauge protector and a self-cleaning pressure-gauge snubber—that are designed to prevent the ruin of pressure gauges. The first one automatically shuts off the flow of air in the line when it exceeds the capacity of the gauge and opens the air valve when the line pressure drops below the cutout pressure. The snubber dampens pressure fluctuations and is available for gas and heavy- and light-fluid services.

A 32-page manual on the care, installation and maintenance of conveyor and elevator belting has been released for free distribution by The B.F. Goodrich Company, Akron, Ohio. It contains numerous illustrations and drawings that indicate how belt service and life can be improved and lengthened; and in a chapter on how to select a belt discusses design, covers, reinforcements and grades. Methods of repair, splicing and fastening also are dealt with in detail, as well as other matters that those concerned with the transmission of materials by belt conveyors should know.



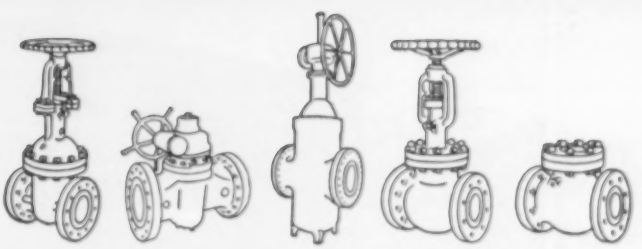
STEEL

COMPLETE LINES OF CAST STEEL VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of pressure classes, types, sizes, and patterns for general industrial use. Walworth also manufactures cast steel valves for specific service applications.

Walworth produces steel bar stock valves, and cast steel valves made of carbon steel, carbon molybdenum steel, corrosion-resistant, and heat-resistant alloy steels. Included are gate, globe, angle, check, and lubricated plug types. Sizes range from ⅛ to 30 inches; pressures range up to 5,000 psi. Full information is contained in Walworth General Catalog 52, a copy of which will be forwarded if requested on business letterhead.

Walworth also manufactures complete lines of valves and fittings made of bronze, iron, and special alloys as well as steel. Walworth-made valves, fittings, and pipe wrenches total approximately 50,000 items.

Walworth engineers will be glad to help you with your problems. For full information, call your local Walworth distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.



Illustrated in section is an 8-inch Series 900, Walworth Pressure-Seal Cast Steel Gate Valve designed for high-pressure, high-temperature service. Pressure-Seal Valves are available in Series 600, 900, 1500 and 2500; sizes 1 to 16 inches. Small Cast Steel Valves, Series 1500, in angle and Y-globe types, are also available in sizes ranging from ¼ to 2 inches.

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Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

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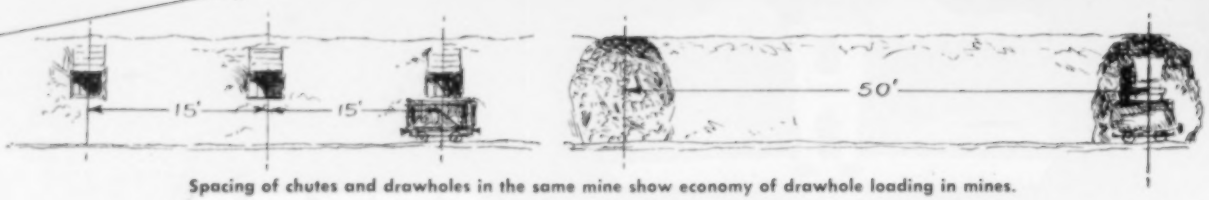

Spacing of chutes and drawholes in the same mine show economy of drawhole loading in mines.

Loading from draw points with mechanical loaders is being used more and more in the development of ore bodies because it has so many advantages. It's cheaper, faster and safer than the chute and grizzly system.

One of the most important differences is the elimination of the grizzly level entirely and the wider spacing of draw points without sacrifice in control of drawing the ore.

Bulletin L1017 shows cost figures on several different operations where chute and grizzly system have been changed over to draw point loading with Eimco loaders. Your copy will be sent on request.

EIMCO A469

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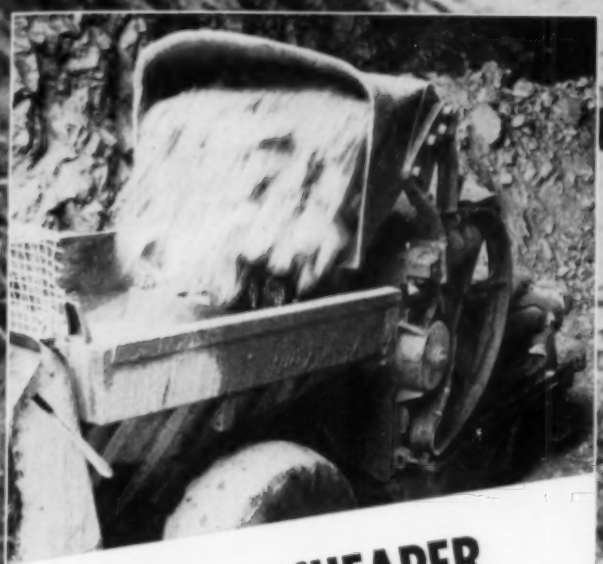
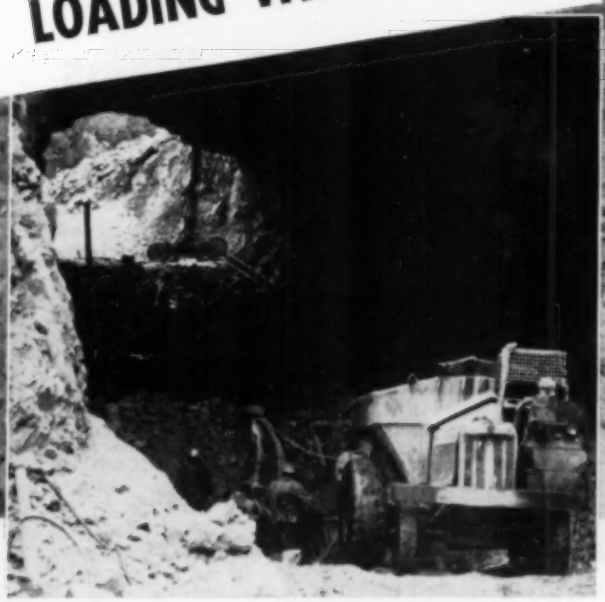


FASTER - CHEAPER LOADING WITH EIMCOS



Eimcos dig and load rock and other materials faster and cheaper than any other method.

In the illustrations above a short division tunnel is being driven on the bench method with one Eimco 104 tractor loader doing all the loading. This has been a good job for the contractor because of the low cost loading performance of his Eimco loader.

For rugged dependability in loading equipment on any size job see your Eimco representative first.

Write for literature on Eimco loaders.

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WITH THESE NEW CAPACITOR MOTORS

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- Die-cast rotors—have no windings or brushes to cause trouble . . . are practically indestructible.

Learn all the many other advantages of these rugged motors. Ask your Westinghouse representative for a copy or write for the free booklet, B-5441, Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-21674-A

YOU CAN BE SURE...IF IT'S

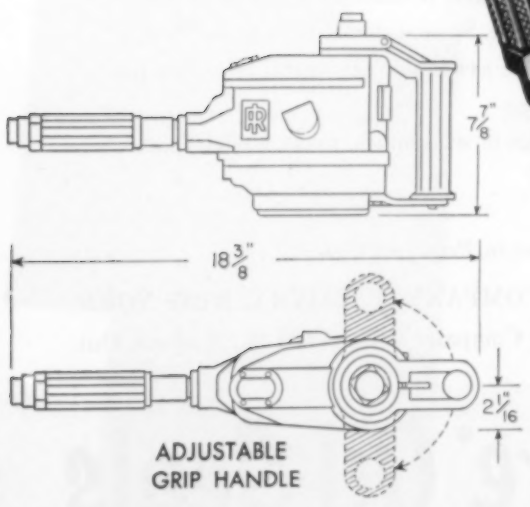
Westinghouse

stop

doing these jobs by hand!

- **STOP STRAINING** on those nuts on high pressure pipe flange jobs.
- **STOP SLUGGING** nuts when repairing steel mill blast furnace gate valves.
- **STOP SWEATING** over those nuts when replacing trays in refinery bubble towers.
- **STOP STRUGGLING** to remove connecting rod bearing cap nuts and oil pan nuts on Diesel locomotives.

Size 518 Air Impactool for ¾" bolt size heavy duty jobs. Weight 23½ pounds.



NEW IMPACTOOL makes tough jobs easy!

The *only* power tool that can be used to do these tough jobs is the new Size 518 Air Impactool. Savings, through greatly reduced downtime, often pay for it on one single maintenance job! The 518 Impactool fits into the tightest places, quickly applies or removes the toughest nuts, with no kick or twist to the operator.

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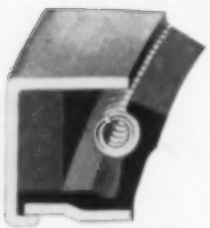
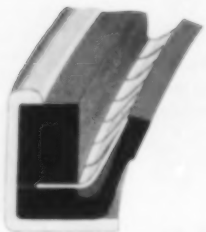
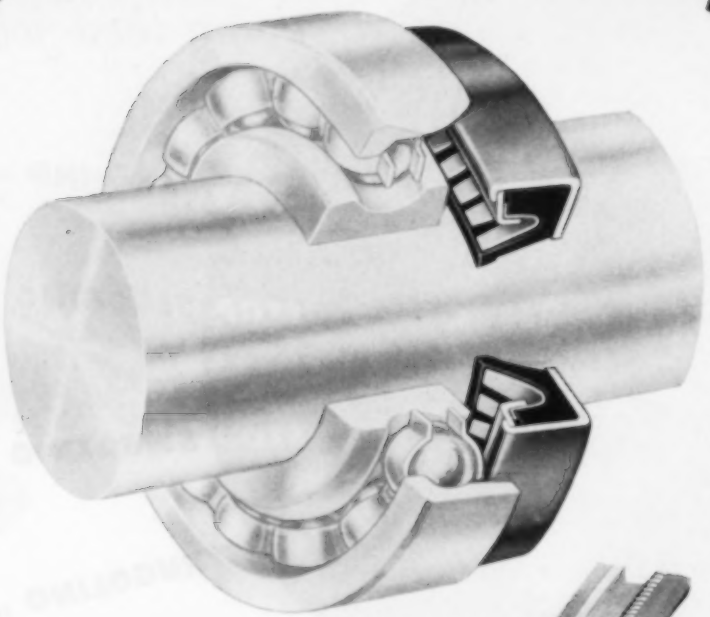


Model 65—A general purpose garter spring seal for moderate speeds.

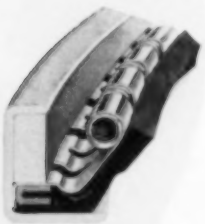


Model 63—A general purpose finger spring seal for normal and high speed service.



Model 53 KLOZURE applied to a shaft to protect the ball bearing.

Model 71-A—A narrow-rind springless seal for needle bearings and other limited space applications.



Model 64—A strong double spring seal for heavy duty service on large shafts.

Model 91-B—A narrow-rind seal with synthetic rubber outer covering for soft metal housings.

DEPENDABLE KLOZURE Oil Seals protect costly bearing installations; they prevent breakdowns and resulting losses in production. That's why many manufacturers of machine tools, gears, speed reducers, and other equipment have standardized on Garlock KLOZURES.

The standard sealing element in the Garlock KLOZURE is made of a synthetic rubber compound that is oil-resistant, non-porous and non-abrasive. Special elements, such as "Teflon" for strong acids and silicone rubber for extreme heat, are available. The metal cases are precision die-stamped.

These superior oil seals are made in a complete range of sizes and in many models; several are illustrated. *Write for KLOZURE Catalog No. 10.*

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In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

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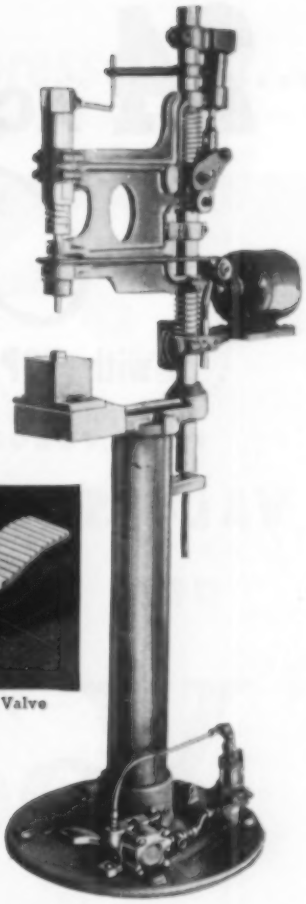
FOR ALL TYPES OF BEARINGS

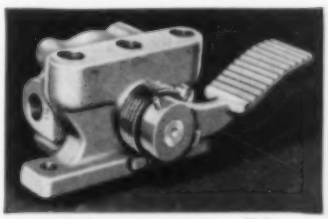
Airflex Pneumatic Riveters

Controlled by NOPAK Model "R" Foot Valve



A touch of the foot pedal on the NOPAK model R Foot Valve . . . which is coupled to a special timing valve . . . initiates an automatic riveting sequence on this and other models of the Airflex Riveter made by the Lemert Engineering Co., Plymouth, Ind. Operator fatigue is minimized and production is increased by this successful application and precision control of air power.

NOPAK 3- and 4-Way Foot Operating Valves are used in many ways on many different types of equipment for the precision control of air power applied to various machine movements. Ask your NOPAK representative to show you other examples in the NOPAK Application Manual.



NOPAK Model "R" Foot Valve

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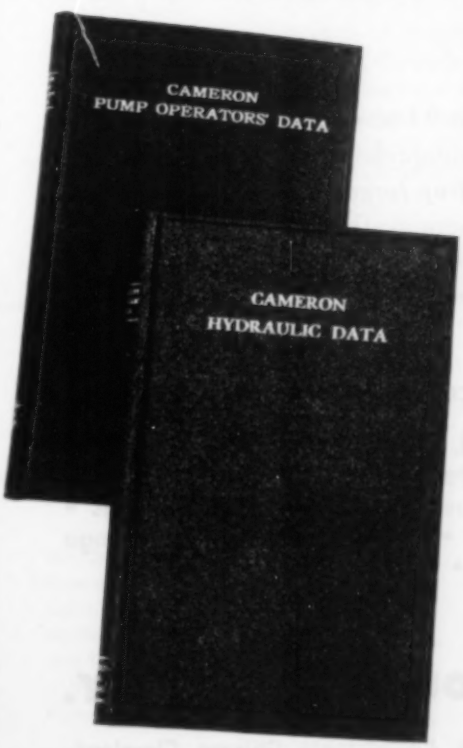

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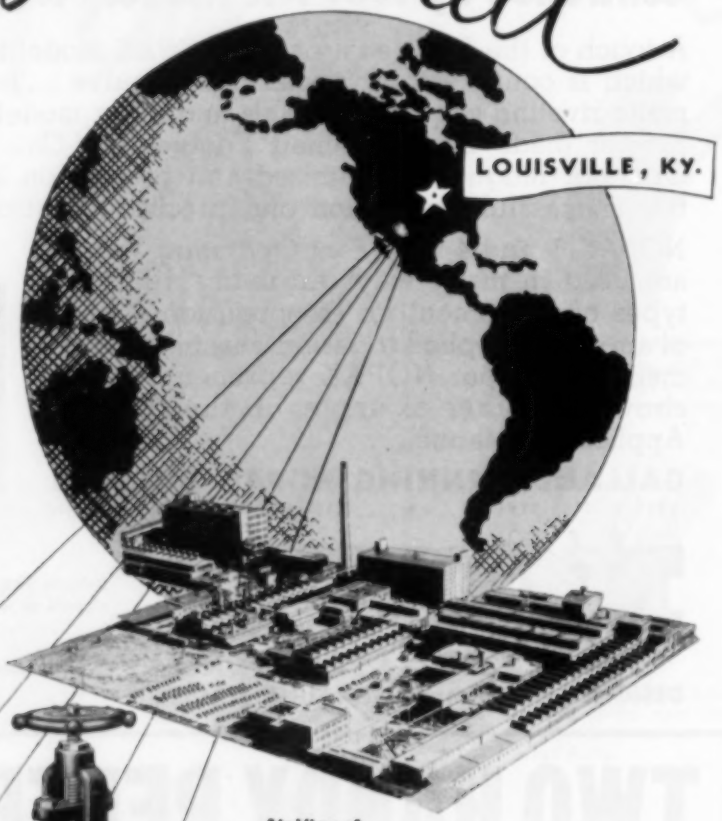

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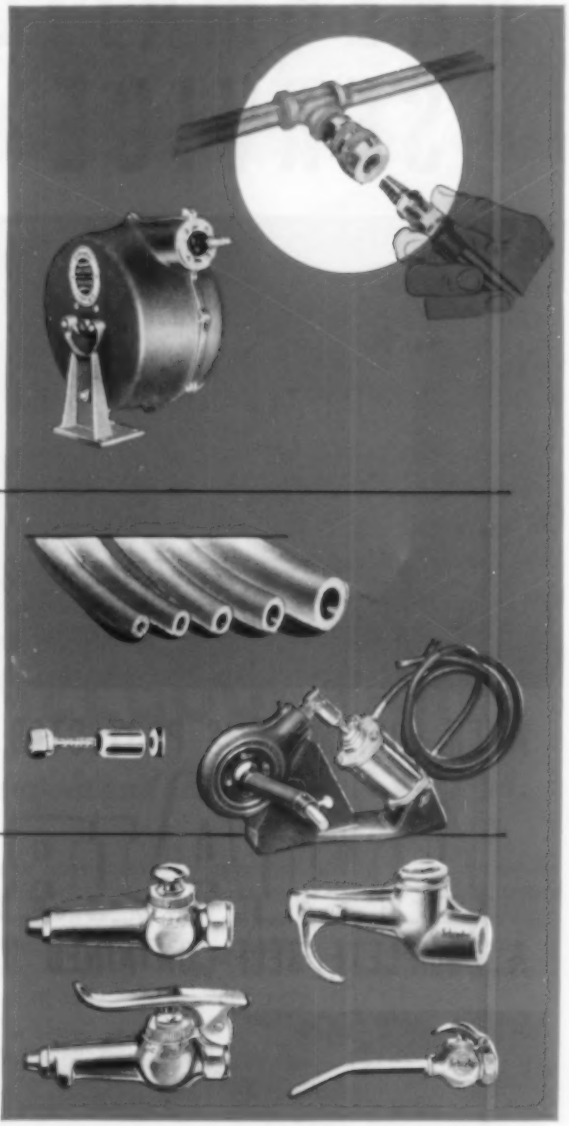

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REMEMBER—from air line to air tool—Schrader is *one reliable source for all air control products.* For further information on the air accessories shown here, write for Bulletin A280—or fill out the coupon below.

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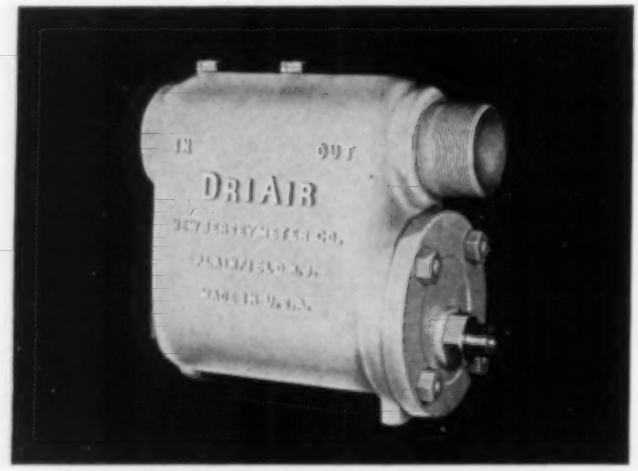
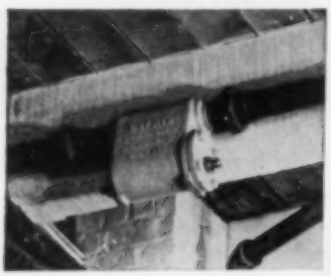


WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

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RANGES 0-10, 30, 60, 100 PSIG
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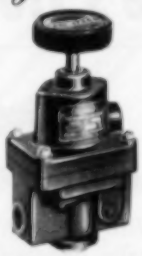

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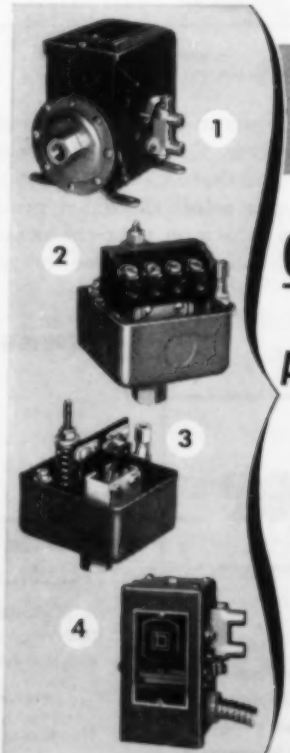

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OF H.P. RATED
AIR COMPRESSOR SWITCHES

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SQUARE D COMPANY

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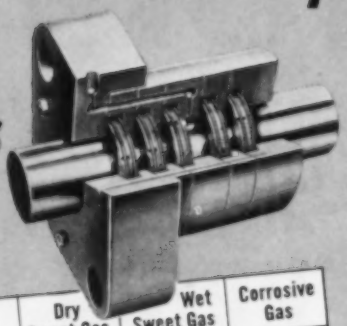

MATERIAL	Dry Sweet Gas	Wet Sweet Gas	Corrosive Gas
Cook Graphitic Iron	X	X	
Cook Graphitic Iron Tinized	X	X	
Cookmet (Plastic Bronze)	X	X	
Cook Babbitt		X	X
Cookroc (Bakelite)			X
Graphitized Cookroc (Bakelite)			X
Hi-Temp Cookroc (Bakelite)			X

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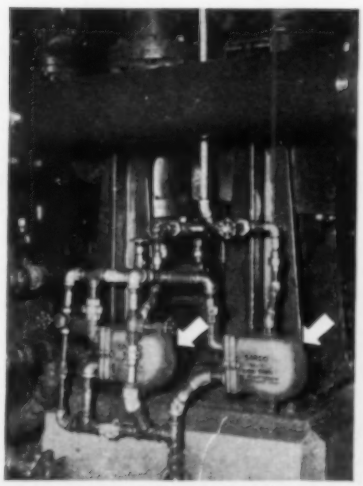

Water accumulating in compressed air systems must be drained off promptly to prevent damage to tools, marred paint surfaces or wetting of material to be cleaned—especially electrical machines.

Sarco Drain Traps should be installed at the aftercoolers (as in our illustration) on separators, at the receiver, and on low points in the lines, to remove all water as it accumulates.

These traps are available for pressures to 750 psi. Operate automatically without waste of air. Technical Bulletin No. 5 will help you get more work from your air compressors at less cost. Write for it to *Sarco Company, Inc., Empire State Bldg., New York 1, N. Y.*

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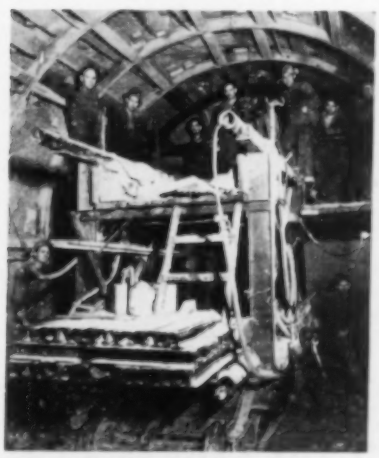

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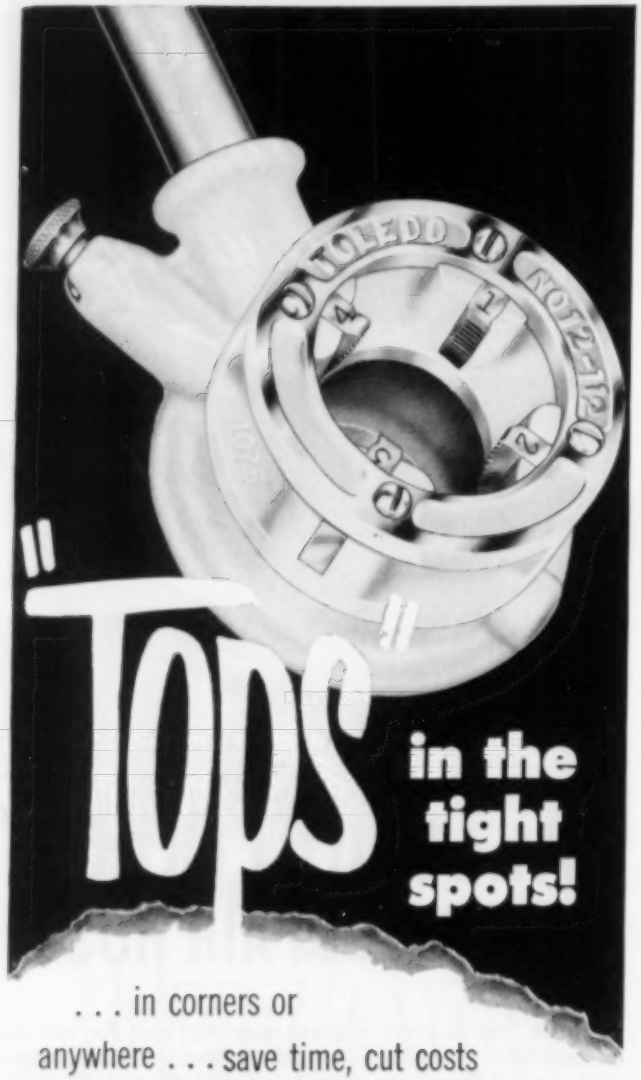

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DROP HEAD TOOLS

HANDY FOR CLOSE CORNER JOBS. These popular Toledo Ratchet Threaders are small, light, compact. Produce clean-cut threads easily . . . anywhere!

QUICK CHANGE OF SIZES. Die heads drop into ratchet from either side, held securely.

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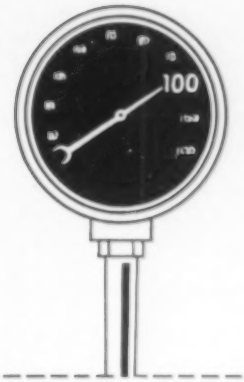
keeping air pressure UP THOUSANDS of feet DOWN



At the Silver Summit Mine in Osburn, Idaho, in a vaulted room more than 1,000 feet below the surface, an Ingersoll-Rand PRE compressor (shown below) converts electric power into air power used to help tear silver, copper and lead ores from the earth.

This spic and span installation, shown below, is reached through a tunnel 6,000 feet long. The 400-hp compressor provides air for mine workings as far as 3,400 feet below it.

Placing the compressor underground has two advantages: First, it eliminates costly piping that otherwise would be necessary to transmit compressed air more than a mile from a surface plant to the working shaft. Second, it avoids air pressure losses that would be caused by leakage and the friction of air passing through a mile-long pipe.

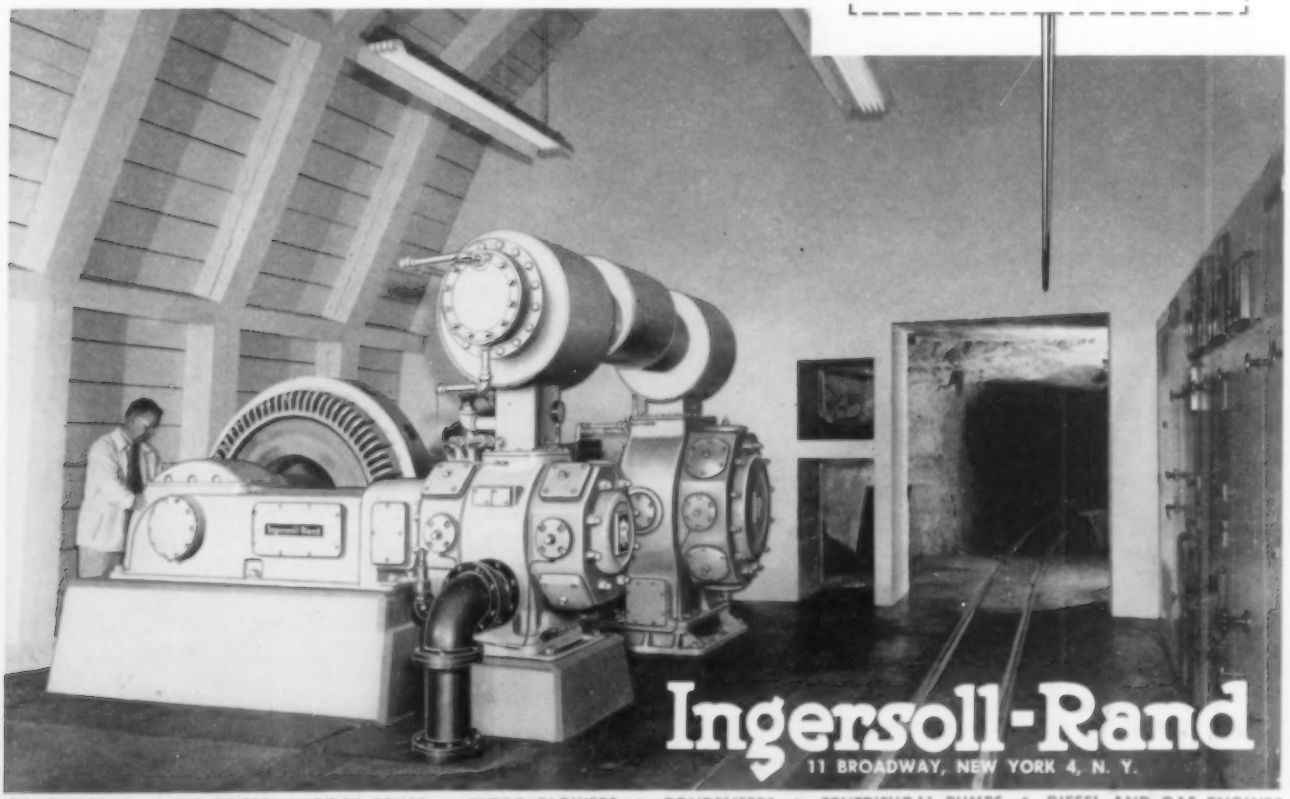
This is not the first underground PRE installation for the Hecla Mining Company whose management controls the operation of Silver Summit Mining Co. It had previously relocated one unit at its Star Mine from the surface plant to an underground station where it also installed a new PRE. This step eliminated the surface plant and the pressure losses formerly caused by 11,000 feet of air piping. Several other I-R compressors have been serving Hecla's older properties for more than 30 years.

Long recognized as a leader in using modern mining equipment to increase production, Hecla mines employ many Jackhamers, drifters, Jackbits, hoists, pumps, and other I-R products.

861-1

FEATURES OF THE "PRE" COMPRESSOR

- Crankcase need not be opened for bearing adjustments . . . stays clean.
- Main bearings have micrometer adjustment from outside of crankcase.
- Full-floating crankpin and crosshead-pin bearings result in long bearing life.
- Unique, built-in, force-feed running gear lubrication eliminates piping both inside and outside compressor.
- I-R stainless-steel Channel Valves are efficient and durable.
- Automatic 5-step full Clearance Control regulates compressor output.
- Built for continuous full-load operation . . . for air or any gas . . . for any pressure . . . sizes from 300 to 3000 hp.



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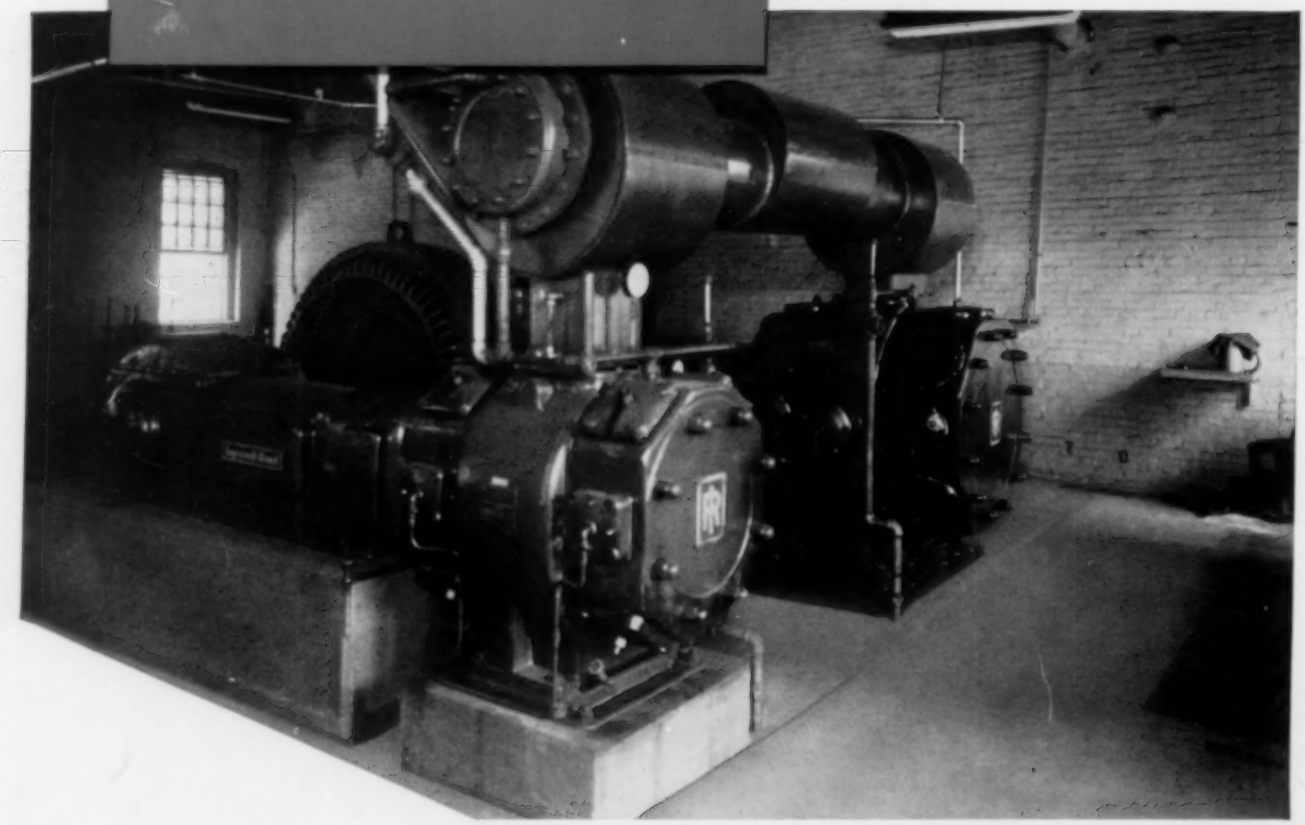

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